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The flower fly genus *Eosphaerophoria* Frey (Diptera, Syrphidae)

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Abstract

The flower fly genus *Eosphaerophoria* is revised. Eight new species are described (*adornata* **sp. n.** Mengual, *bifida* **sp. n.** Mengual, *brunettii* **sp. n.** Ghorpadé, *hermosa* **sp. n.** Mengual, *luteofasciata* **sp. n.** Mengual, *nigrovittata* **sp. n.** Mengual, *symmetrica* **sp. n.** Mengual, and *vietnamensis* **sp. n.** Mengual), and an identification key is provided. Redescriptions, illustrations, synonymies, diagnoses and distributional data are given for all 11 known species of *Eosphaerophoria*. The new described species increase the genus' distribution, now recorded from Nepal and Sri Lanka east to New Guinea. All information data, images and drawings, as well as additional images and relevant information, are available online via the internet as an example of the utility of international standards for biodiversity informatics.

Keywords

Taxonomy, identification key, Syrphinae, new species, cybertaxonomy

Introduction

Eosphaerophoria Frey, 1946 is a little known genus of flower flies (Diptera: Syrphidae) found in the Australasian and Oriental Regions, ranging from Nepal and Sri Lanka (but not India in between) to the Philippines and New Guinea. Less than a dozen

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specimens have so far been reported in the literature, representing three described and one undescribed species (Vockeroth 1969: 135). The relationships with other genera or its closest taxon are unknown, but *Eosphaerophoria* is currently placed within the tribe Syrphini of the subfamily Syrphinae.

Frey (1946) designated a new genus, *Eosphaerophoria*, for his species *marginata* based on three males and one female collected on Mt. Banahao (Luzon, Philippines). He pointed out the similar habitus of his new genus and *Sphaerophoria* Lepeletier & Serville, 1828 (tribe Syrphini, subfamily Syrphinae), but the abdominal pattern of *E. marginata* resembled that in *Toxomerus* species (tribe Toxomerini, subfam. Syrphinae). Although *Neoascia* Williston, 1887 (tribe Brachyopini, subfam. Eristalinae) was also mentioned in his diagnosis, some differences with *Eosphaerophoria* spp. were obvious, such as their swollen metafemur and produced face without facial tubercle. Keiser (1958) erected the genus *Tambavanna* for a peculiar new species. *Tambavanna dentiscutellata* Keiser, 1958 was based on a single male collected in central Sri Lanka, and he stated its resemblance to *Sphaerophoria* and some similarities with *Ocyptamus (Calostigma)*, both members of the tribe Syrphini, but referred his new genus to the tribe Bacchini (subfam. Syrphinae) *sensu* Hull (1949), based on the slightly narrowed abdominal base and reduced alula and anal lobe.

In his major generic revision of the tribe Syrphini, Vockeroth (1969) synonymized *Tambavanna* under *Eosphaerophoria* and placed it within the tribe Syrphini indicating the absence of similarity with the genus *Baccha sensu stricto*. Vockeroth provided a general genus description where he indicated some morphological characters diagnostic of the genus, like dichoptic males, the nearly vertical apical crossvein [vein M_1 *sensu* Thompson (1999a)] and the subtriangular scutellum. The asymmetrical male genitalia and a reduced anal lobe and alula are characters shared with the genus *Giluwea* Vockeroth, 1969, but he did not think they were closely related. Vockeroth also noted that an undescribed *Eosphaerophoria* species from New Guinea had superior lobes of male genitalia symmetrical. As mentioned by Vockeroth, dichoptic males are uncommon in the tribe Syrphini, only present in some species of *Melangyna*, *Allograpta*, *Rhinobaccha* and also shared by the genera *Giluwea* and *Eosphaerophoria*.

Recently, Claussen and Wiepert (2003) described the third species of *Eosphaerophoria* from the Annapurna Region (Nepal) based on a single female. Their new species *E. punctata* has no distinct notopleural protuberance, unlike the other two described species, and has a dorsomedial yellow macula on the black 2nd abdominal tergum (Fig. 30).

The *Eosphaerophoria* species have never been revised and the only identification key to the described species was provided by Claussen and Weipert (2003). The aim of this revision is to describe the eight new species of *Eosphaerophoria* we have recognized, to provide redescriptions of two known species and to present an identification key to all. At the same time, another objective is to present an example of cybertaxonomy (Penev et al. 2008) for Syrphidae with numerous web resources.

Material and methods

Redescriptions, complete synonymies, illustrations, and distributions are given for all species, except *punctata* Claussen & Weipert, 2003. Terminology follows Thompson (1999a). New terms for the aedeagus (male genitalia) are used here for the first time, recognizing a basal and an apical part (see Fig. 44). Speight (1987) called these two parts as tubus and pyxis for apical and basal parts of aedeagus. He also named the basal appendices of aedeagus as harpes, name not recorded in Thompson (1999). More recently, Cumming and Wood (2009) used the terms basiphallus and distiphallus, equivalents to basal and apical portion of aedeagus respectively.

The format for and abbreviations in the generic synonymy follow the BioSystematic Database of World Diptera (BDWD; Thompson 1999b). The acronyms used for collections likewise follow BDWD standards and their equivalents are given in the acknowledgments. The museum or collection holding appears in square brackets after each specimen. Every specimen was registered in the Diptera database of the National Museum of Natural History (USNM) providing a unique barcode and number for easy identification. These barcodes are listed in the text after each individual, i.e. USNM ENT00036560. Moreover, names of the new species were included in the Nomenclator of the BioSystematic Database of World Diptera (http://www.diptera.org/). All listed specimens were examined, otherwise it is explicitly noted.

All measurements are in millimeters and were taken using a reticule in a Wild M5A microscope. Illustrations of male genitalia were drawn using a camera lucida mounted on an Olympus BX51 compound microscope with the help of a Nikon SMZ1500 microscope. Manual drawings were redrawn as a vectorial image using Adobe Illustrator (version CS3). Illustrations of male and female abdomens were composed using the same software but based on images of pinned specimens taken with a Canon EOS40D mounted on a Microptics Camlift and the help of Adobe Lightroom (version 2).

All images included in this publication have been deposited in MorphBank (http://www.morphbank.net). The direct hyperlink for each taxon is given and extra colour pictures of the species can be found in the online collections. New taxonomic names proposed in this paper have been registered with ZooBank (http://www.zoobank.org/) as part of the ZooKeys publication process, and all taxon names have a Life Science Identifiers number (LSID) following each name (Penev et al. 2008).

Information for all specimens is a direct copy of the labels with no modification of what was written. For all specimens, labels are indicated by quotation marks (“ ”), with each line in the label separated by a double slash (//), and handwriting information in labels is indicated by italics. Updated and more complete data for each specimen can be found in an Excel file named Appendix A. In the “Type locality” paragraph, current country names and new data, such as province or district, are given, as well as geographic coordinates. Most of the specimens lack information about geographic coordinates on their labels, but we consider these data important to locate sampling points in a map or to share them with GBIF. Google Earth was used to locate the type localities easily (see Appendix B) and to get the geographic coordinates used in this

work. When no precise data about locality were written or they defined a large area in the map (e.g. type locality for *Eosphaerophoria adornata*), an approximated point was used to represent the label locality. In these cases, registered altitude in the label helped to locate the collecting point.

Collection data has been shared (via Appendix A) with the Global Biodiversity Information Facility (GBIF, http://www.gbif.org/). A kml file for viewing distribution records interactively in Google Earth (http://earth.google.com/) is available for download as Appendix B. Our intention is that the paper edition of this work be enlarged when combined with additional material found online such as colour photographs deposited in MorphBank (Penev et al. 2009).

Genus *Eosphaerophoria* Frey

Eosphaerophoria Frey, 1946: 169. Type-species, *marginata* Frey (original designation). Vockeroth 1969: 134, map 26 (distribution), Figs 11 (wing), 89 (male genitalia) (key reference, description, distribution); Knutson et al. 1975: 313 (catalog citation); Thompson and Vockeroth 1989: 443 (catalog citation); Ghorpadé 1994: 3, 5 (citation, key); Mengual et al. 2009: 7, 8, 23 (citation, morphological characters, phylogenetic analysis).

Tambavanna Keiser, 1958: 202. Type-species, *dentiscutellata* Keiser (original designation). Synonymy by Vockeroth (1969: 134).

Description (adapted from Vockeroth 1969: 134). Small slender species with male narrowly dichoptic, mesonotum bright yellow laterally, scutellum usually subacute or acute apically, abdomen of male very slightly petiolate, abdomen of female slightly broadened from base to near apex. Length from 4.9 mm to 6.8 mm.

Head. Eye bare. Face slightly broadened below, yellow, with or without medial black vitta, with a tubercle small but well defined, rather compressed in male. Antenna short, less than head width; scape about as broad as long; pedicel broader than long; basoflagellomere oval to slightly elongate, not more than 1.3 times as long as broad; arista dorsobasal, bare. Frons of male very narrow, at antenna about 1/5 head width, narrowed to 1/8 to 1/10 head width a little below anterior ocellus, then very slightly broadened to vertex; frons of female broader, narrowed gradually to posterior ocellus, then parallel-sided to vertex. Ocellar triangle, especially in male, well before postero-median angle of eye; anterior ocellus separated from eye by much less than its diameter.

Thorax. Scutum black, with postpronotum, broad presutural stripe (notopleuron) and narrower postsutural stripe yellow; black dorsomedial area usually with opaque margin and shining or sub-shining centre. Postpronotum bare. Notopleuron with posterolateral angle sometimes produced postero-laterad into a strong blunt tubercle which extends distinctly caudad of suture (Fig. 28). Scutellum with basal black triangle and yellow margin, subtriangular in outline with apex bluntly rounded, subacute, or produced into a short, acute, sometimes upcurved tubercle. Subscutellar fringe very

short and present only laterally or entirely absent. Pleura yellow (propleuron, anepisternum, anepimeron, katepimeron and katatergum), except katepisternum black with a dorsal yellow macula and meron black. Thoracic pile extremely short and sparse. Katepisternum with dorsal and ventral pile patches broadly separated, the pile in the dorsal patch extremely short or absent, scarcely distinguishable. Metasternum bare. *Legs*. Simple; metafemur near apex sometimes with a ventral row of short strong black spine-like setae. *Wing*. Vein M_2 short, perpendicular or nearly so to M_1; vein M_1 (apical crossvein) straight or slightly sinuate, meeting R_{4+5} at approximately a right angle at more than half its own length from wing base (see Figs 22 and 23); posterior margin without black sclerotized puncta. Alula narrow, narrower than cell BM, anal lobe greatly reduced. Wing partially bare basomedially: 2nd costal cell bare; cells R_1, R_{2+3}, R_{4+5}, DM, CuA_1 and CuP bare basally; cells BM and R bare; anal lobe sparsely microtrichose distally; alula usually microtrichose (see Fig. 22). The proportion bare on each cell can vary slightly between species.

Abdomen. Abdominal pattern variable; terga without marginal sulcus; in male very slender and slightly to rather strongly narrowed on segments 2 and 3, 2nd abdominal tergum narrower than thorax; in female broader, narrowest near base of segment 2. *Male genitalia*. Usually large reaching the posterior margin of 4th sternum; typical syrphine form; cercus elongate oval; surstylus elongate, broad basally; lingula absent; aedeagus two-segmented, with apical segment flared apically; superior lobe variable, articulated with aedeagal base and with lateral surface covered with short black blunt bristles.

Etymology. *Eosphaerophoria* is derived from the prefix "*eos*", from the Greek (*heos*), meaning "east, eastern, oriental" (Brown 1956: 303) and the name *Sphaerophoria*. Thus *Eosphaerophoria* means eastern or oriental *Sphaerophoria*, clearly referring to the similar adult habitus in both genera. On the other hand, *Sphaerophoria* is a combination of "*sphaera*", from the Greek (*sphaira*), meaning "ball, globular, sphere" (Brown 1956: 736) and "*phoras*", from the Greek (*phero*), meaning "bearing, carrying" (Brown 1956: 604). Accordingly, *Sphaerophoria* adduces to the globular, spherical male genitalia of most of the species of this genus (Vockeroth 1969; Knutson 1973). *Eosphaerophoria* species also have large rounded male genitalia.

Frey (1946) did not establish the gender of his new genus, *Eosphaerophoria*, nor Keiser (1958) for *Tambavanna*, but both authors used a feminine form for species epithet (*marginata* and *dentiscutellata* respectively). According to the article 30.2.3 of the International Code of Zoological Nomenclature (ICZN 1999), and in agreement with the article 30.2.4, *Eosphaerophoria* must therefore treated as feminine, and new species names follow this gender.

Biology. Nothing is known of the biology of these flies. Keiser (1958: 204) merely stated that he collected his specimen in grass in a swampy locality. No other biological details have been published about *Eosphaerophoria*.

Distribution. *Eosphaerophoria* is only found in Oriental (Indomalayan) and Australasian biotic regions (see Fig. 21). Specimens from Nepal, Sri Lanka, Thailand, Malaysia, Vietnam, Indonesia, Philippines, and Papua New Guinea have been reported (see below in each species description).

Diagnosis. As mentioned above, the genus *Eosphaerophoria* is recognized among the syrphines (subfamily Syrphinae, tribe Syrphini) by this combination of characters: 1) nearly vertical apical vein M_1 (see Figs 22 and 23); 2) subtriangular scutellum; 3) male narrowly dichoptic; 4) slightly narrowed abdominal base in males; and 5) reduced alula and anal lobe.

Vockeroth (1969) considered this genus the most aberrant of the Syrphini based on the presence of uncommon morphological characters, such as wing venation and dichoptic males (see figs 26 and 27), but noting also the asymmetry of the superior lobes of the male genitalia. This character cannot be considered diagnostic because there are species with symmetrical superior lobes too, as pointed out by Vockeroth (1969) (see Figs 44, 45, 47 and 49).

No closely related taxa have been previously proposed. Mengual et al. (2008a) analysed the current tribal classification of the subfamily Syrphidae, but *Eosphaerophoria* was not included due to the absence of suitable material for DNA extraction. Mengual et al. (2009) in their cladistic analysis of *Allograpta* using morphological characters, included representatives of *Episyrphus*, *Meliscaeva*, *Anu*, *Citrogramma*, *Exallandra*, *Giluwea*, *Sphaerophoria* and *Eosphaerophoria* based on adult morphological similarity. *Eosphaerophoria* was resolved in a polytomy with the *Allograpta* subgenera *Antillus*, *Allograpta*, *Costarica* and *Rhinoprosopa* in the strict consensus tree. Consequently, its phylogenetic position remains incognito but if the overall morphological similarity with *Sphaerophoria* is taken under consideration, the genus might be a member of the *Allograpta-Sphaerophoria* clade recovered by Mengual et al. (2008a, 2008b). Thus we include a generic key for *Eosphaerophoria* and related genera here below.

Ghorpadé (1994: 5) placed together *Rhinobaccha* de Meijere, 1908 and *Eosphaerophoria* in couplet 13 of his identification key. Although *Rhinobaccha* was not included in previous molecular or morphological analyses and its relationships with other genera are unclear, we decided to include this genus in the following key.

Key to *Eosphaerophoria* and related genera

1. Metasternum pilose 7
– Metasternum bare **2**
2. Scutum with lateral yellow interrupted, black after transverse suture **5**
– Scutum yellow laterally after transverse suture **3**
3. Plumula present (Fig. 1). Face broad, about 1/2 as wide as head measured at antennal base level, always more than 1/3 (Fig. 2). Male holoptic ..... ***Citrogramma***

   Vockeroth, 1969: 92. Type-species, *Syrphus hervebazini* Curran, 1928, original designation
– Plumula absent (Fig. 3). Face narrower, at most 1/3 as wide as head (Figs 19, 20, 27). Male dichoptic **4**
4. Scutellum subtriangular, its apex subacute or with pointed tubercle; yellow with basomedial black triangle (Fig. 4). Vein M_1 nearly perpendicular to R_{4+5}, straight or nearly so (Figs 22, 23). Pleura entirely yellow, except meron black

and katepimeron black ventrally (Fig. 7). Metafemur yellow on basal 1/2 to 3/5, black apically (Fig. 7)..... ***Eosphaerophoria***

Frey, 1946: 169. Type-species, *Eosphaerophoria marginata* Frey, 1946 original designation

– Scutellum with posterior margin rounded, yellowish (Fig. 5). Vein M_1 sinuate (Fig. 8). Pleura completely yellow (Fig. 9). Metafemur entirely yellow (Fig. 9) (New Zealand)..... ***Allograpta*** [***A. ventralis***]

(Miller, 1921). Originally described as *Ocyptamus ventralis* Miller, 1921

5. Scutellum concave apicomedially with subscutellum greatly produced so as to be visible dorsally (Figs 6, 10). Face straight, with tubercle (Fig. 10); alula broader than second costal cell. Male terga reduced apicomedially so that the abdomen may be bent into an apicodorsal curve (almost always in dead specimens) (Fig. 10) (New Zealand) .....***Anu***

Thompson, 2008: 9. Type-species, *Anu una* Thompson, 2008 original designation

– Scutellum with posterior margin rounded, subscutellum normal. Face produced anteriorly (Figs 11, 14); alula as broad as or narrower than second costal cell (Fig. 13). Male abdomen without those characters **6**

6. Costa with strong black swelling at extreme base (Fig. 13). Face with medial tubercle (11). Male broadly dichoptic, separated by more than ocellar triangle width (Fig. 12). Wing completely microtrichose (New Guinea)..... ***Giluwea***

Vockeroth, 1969: 136. Type-species, *Giluwea flavomaculata* Vockeroth, 1969 original designation

– Costa normal, without swelling. Facial tubercle absent (Fig. 14). Male narrowly dichoptic, separated by ocellar triangle width or less (Fig. 15). Wing microtrichose, bare basomedially (Sri Lanka, Southern India) .... ***Rhinobaccha***

de Meijere, 1908: 315. Type-species, *Rhinobaccha gracilis* de Meijere, 1908 monotypy

7. Abdomen distinctly margined on at least tergite 4; usually oval, broader than thorax. Scutum usually black, pollinose with medial section with bluish metallic iridescence .....***Citrogramma***

Vockeroth, 1969: 92. Type-species, *Syrphus hervebazini* Curran, 1928 original designation

– Abdomen unmargined; elongate with parallel sides (as wide as thorax) or petiolate. Scutum black, normally shiny..... **8**

8 Subscutellar fringe usually entire, sometimes sparse but complete. Male genitalia: superior lobe fused basally with hypandrium (Fig. 16) ....***Allograpta***

Osten Sacken, 1875: 49, 63. Type species, *Scaeva obliqua* Say, 1823 original designation

– Subscutellar fringe completely absent or with pile restricted laterally, with median section bare. Male genitalia: superior lobe free and articulated with hypandrium; basal aedeagus simple, not swollen nor with denticules **9**

9. 5th abdominal tergum narrow, about two times as broad as long. Male genitalia small, with epandrium half as wide as abdomen or less (Fig. 17). Pleura black dorsad procoxa. Notopleuron mostly black, yellow on anterior 1/2 (Afrotropical)..... ***Exallandra***

Vockeroth, 1969: 87. Type-species, *Syrphus cinctifacies* Speiser, 1910 original designation

– 5th abdominal tergum broad, about as broad as long. Male genitalia large, with epandrium about as wide as abdomen (Fig. 18). Pleura usually with yellow macula dorsad procoxa. Notopleuron yellow (widespread but absent in Neotropics) ..... ***Sphaerophoria***

Le Peletier & Serville, 1828: 513. Type-species, *Musca scripta* Linnaeus, 1758 designated by Rondani, 1845: 458

Key to species of *Eosphaerophoria*

1. Notopleuron with obtuse protuberance posterolaterally (Fig. 28) **4**
– Notopleuron swollen but not produced posterolaterally (Fig. 29), or at least protuberance not as evident as in Figure 28 ..... **2**
2. 2nd abdominal tergum black dorsally; 5th abdominal tergum with 2 lateral subtriangular yellow maculae (Fig. 38); scutum with lateral yellow vitta behind transverse suture narrower, with dorsal margin not in line with the dorsal margin of yellow notopleuron (Fig. 29) (Malaysia) ..... ***brunettii***
– 2nd abdominal tergum black with dorsomedial yellow macula; 5th abdominal tergum with yellow fascia (Figs 30, 31); scutum with lateral yellow vitta behind transverse suture with dorsal margin in line with the dorsal margin of yellow notopleuron (Fig. 28) **3**
3. 1st abdominal tergum yellow with posterodistal narrow black fascia (Fig. 30); frons black with 2 basolateral yellow areas on ventral 3/4, about 1/3 of frons width each (Figs 26, 27) (Nepal) ..... ***punctata***
– 1st abdominal tergum yellow with 2 subtriangular large black maculae on posterior margin (Fig. 31); frons yellow on ventral 4/5, black on dorsal 1/5 (Vietnam) ..... ***symmetrica***
4. Scutellum with rounded or pointed posterior margin, but without tooth on medial section (Figs 28, 29, 30) 7
– Scutellum with tooth on medial posterior margin (Fig. 4) **5**
5. 1st abdominal tergum yellow with posteromedial narrow black fascia (Fig. 32); face yellow with medial black vitta (Indonesia, Halmahera Island) ..... ***hermosa***
– 1st abdominal tergum black dorsomedially, yellow on anterior and lateral margins; face entirely yellow **6**
6. 2nd abdominal tergum black, yellow on anterobasal margins only (Fig. 33); 5th abdominal tergum with 2 small lateral yellow maculae (Fig. 33) (Sri Lanka) ..... ***dentiscutellata***
– 2nd abdominal tergum black with basal yellow fascia with a posterior median triangular projection, narrowly separated from anterior margin by a black fascia (Fig. 34); 5th abdominal tergum with subbasal yellow fascia (Fig. 34) (Papua New Guinea, Normanby Island) ..... ***adornata***

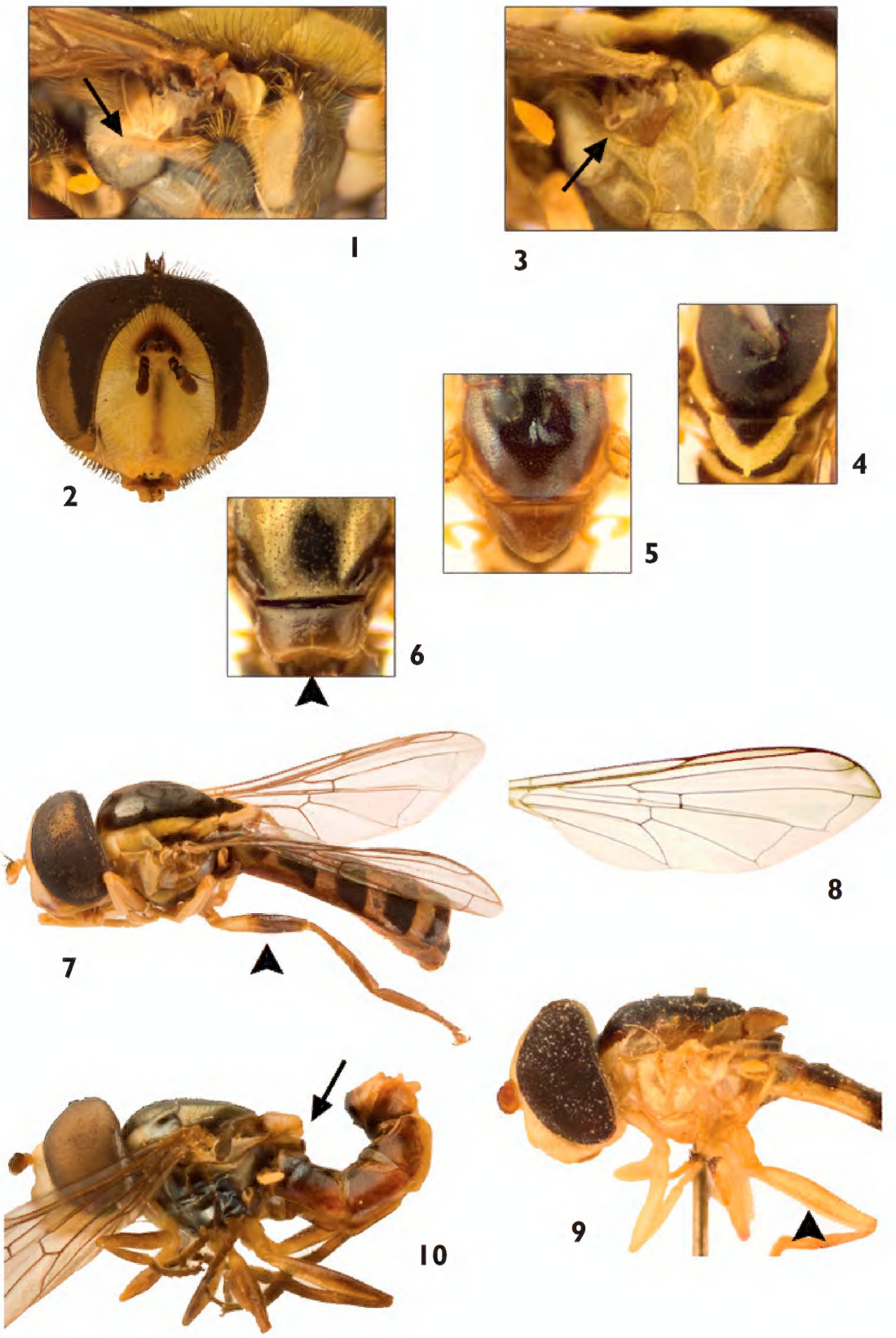
7. 2nd abdominal tergum with yellow fascia on anterior 1/2, about 1/4 of tergum length (Fig. 35); 3rd and 4th abdominal terga with basal yellow fascia broader, about 1/2 of tergum length (Fig. 35); 5th abdominal tergum with anterior yellow fascia. Scutellum triangular with tip pointed, not rounded or produced into a tooth (Papua New Guinea, New Ireland Island)..... ***luteofasciata***
– 2nd abdominal tergum withour yellow fascia, entirely black dorsally or with central yellow macula; 3rd and 4th terga usually with narrower yellow fascia but variable..... **8**
8. 5th abdominal tergum with 2 lateral small yellowish maculae (Figs 39–43).....**10**
– 5th abdominal tergum black with anterior yellow fascia (Figs 36, 37) **9**
9. Face with a medial broad black vitta; 2nd tergum black dorsally, without central yellow macula (Fig. 36) (Papua New Guinea, Indonesia – New Guinea island)..... ***nigrovittata***
– Face yellow (Fig. 24); 2nd tergum black dorsally with central elongated yellow macula (Fig. 37) (Papua New Guinea)..... ***bifida***
10. Frons yellow on basoventral 4/5 with very thin medial black vitta that may or may not reach antennal bases, black on dorsal 1/5 (Fig. 20). Face yellow. Notopleuron slightly produced posterolaterally (less evident than in Fig. 28) (Vietnam, Malaysia)..... ***vietnamensis***
– Frons black, yellow on basolateral 2/3 with medial broad black vitta; at antennal bases, central black area is about 1/3–1/2 of the face width (Fig. 19). Male: face yellow. Female: face yellow with medial black vitta. Notopleuron clearly produced posterolaterally (Fig. 28) (Philippines, Thailand) .... ***marginata***

Eosphaerophoria adornata **Mengual, sp. n.**
urn:lsid:zoobank.org:act:DD7DF7F2-06A4-4071-B822-6A2D466B880D
Fig. 34; MorphBank [http://www.morphbank.net/?id=478063]

Vockeroth 1969: 135 as *Eosphaerophoria* sp. (citation).

Male. Unknown.

Female. *Head*. Face straight, broad, with distinct round tubercle, yellow with a median area without pigmentation (including also ventral face and oral apex), almost transparent so that it appears to have a dark vitta, yellow pilose; gena yellow; lunula black; frons completely black on dorsal 1/3 (length between anterior ocellus and lunula), yellow on basolateral 2/3 with medial broad black vitta (about 2/5 of frons width), yellow pilose; vertex and vertical triangle black, black pilose; ocelli brownish; antenna yellow; basoflagellomere brown dorsally, elongated (no more than 1.5 times longer than broad); arista brown; occiput mainly black, yellow ventrally, yellow pilose and silvery pollinose ventrally, black pilose and golden pollinose dorsally.



Figures 1–10. 1 *Citrogramma henryi*, lateral view of pleura showing plumula **2** *Citrogramma variscutatus*, frontal view of male head **3** *Eosphaerophoria marginata*, lateral view of pleura showing the wing base **4** *Eosphaerophoria adornata*, dorsal view of scutellum **5** *Allograpta ventralis*, dorsal view of scutellum **6** *Anu una*, dorsal view of scutellum showing the subscutellum **7** *Eosphaerophoria adornata*, lateral view **8** *Allograpta ventralis*, wing **9** *Allograpta ventralis*, lateral view of male head, thorax and legs **10** *Anu una*, lateral view of male showing the subscutellum.

Thorax. Scutum mainly black, shiny medially, black pollinose sublaterally, yellow laterally with lateral broad yellow stripe from postpronotum to scutellum, narrower after transverse suture with ventral black area, golden brown pilose; postpronotum yellow; notopleuron yellow with a distinct posterolateral obtuse protuberance; scutellum triangular, yellow with dorsomedial triangular black area con-

tinuing from posterior mesonotum, with small tooth on medial posterior margin (shorter than the width of the yellow scutellar margin), golden-brown pilose; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter brownish yellow. *Wing*. Wing bare basomedially.

Legs. Pro- and mesoleg entirely yellow, except mesocoxa and mesofemur dorsolaterally slightly darker, yellow pilose except tarsi with short black setulae ventrolaterally; metacoxa and trochanter dark yellow, yellow pilose; metafemur yellow on basal 1/3, black on distal 2/3, yellow and brown pilose; metatibia black, golden brown pilose; metatarsus black, golden yellow and brown pilose.

Abdomen. Fig. 34. Dorsum mainly black, black pilose except 1st tergum yellow pilose laterally; 1st tergum black with anterior and lateral yellow margin, medially reaching anterior margin of 2nd tergum dividing black area in 2 triangular maculae that become brownish anteriorly; 2nd tergum black dorsally with basomedial very narrow black fascia not reaching margins and with basal yellow fascia, about 1/3 of tergum length, produced posteriorly in small triangular emargination, narrowly yellow laterally on basal 3/4 continuing the yellow margin of 1st tergum; 3rd and 4th terga similar to 2nd tergum, 3rd tergum laterally almost entirely yellow and 4th tergum narrowly yellow laterally on basal 3/4; 5th tergum black with basal yellow fascia on anterior 1/2 or slightly broader; 6th tergum black with basomedial very narrow black fascia and basal yellow fascia on anterior 1/2; sterna brownish-yellowish, with short yellow pile; 5th, 6th and 7th sterna with long erected black hairs medially on posterior margin.

Variation. Paratype female has completely yellow antenna, and pro- and mesolegs all yellow. The 1st abdominal tergum is brownish with a yellow margin, a bit lighter than in the holotype, and the 2nd abdominal tergum is almost all yellow laterally.

Type locality. PAPUA NEW GUINEA: Milne Bay. Normanby Island, Wakaiuna, Sewa Bay. 9°59'47.79"S 150°58'08.47"E. Original labels do not have coordinates, thus this collecting point was placed in the middle of Sewa Bay in the kml file.

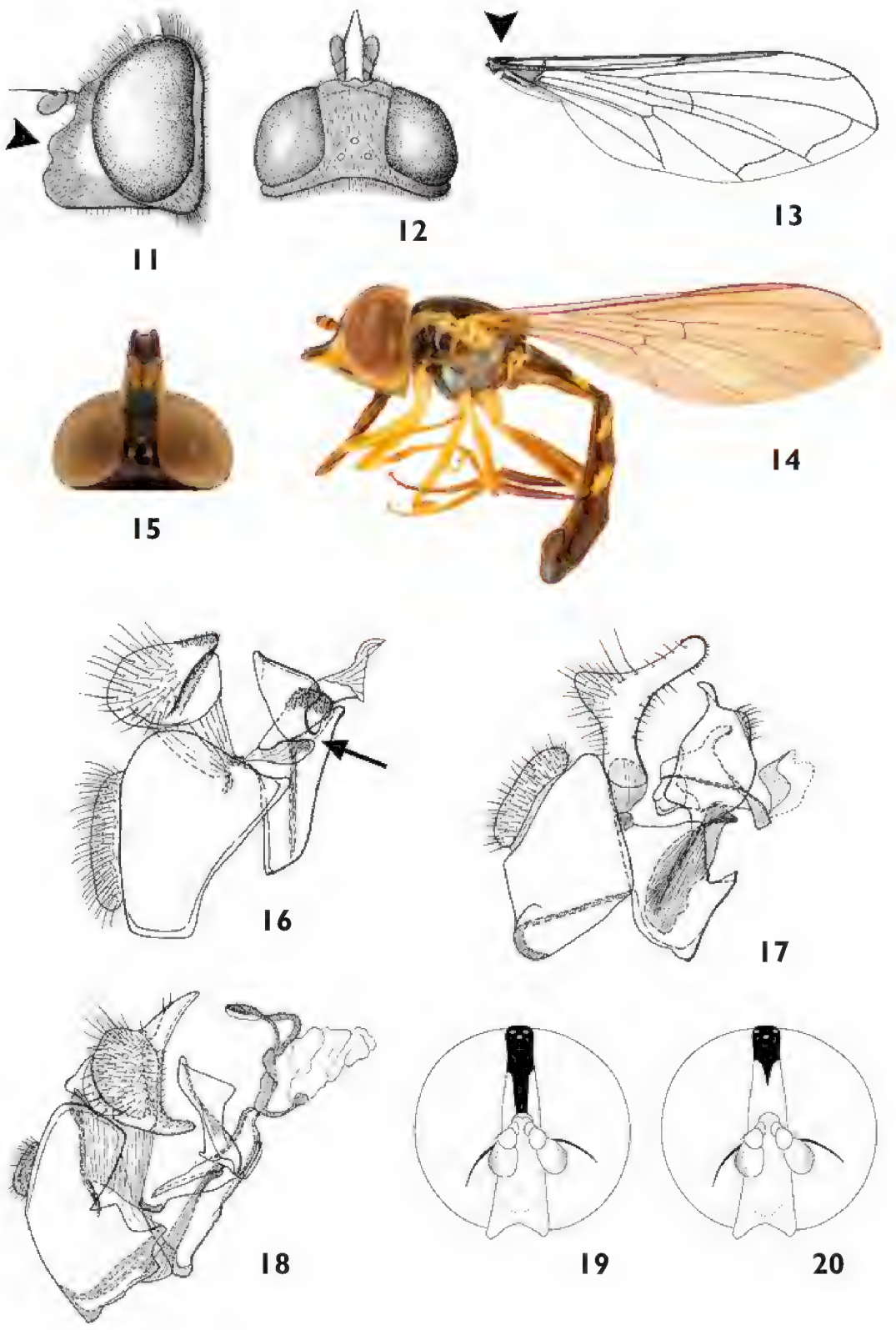
Types. ***Holotype:*** "NEW GUINEA: PAPUA // Normanby I. // Wakaiuna, Sewa Bay // Oct. 25-30-1956' "W.W. Brandt // Collector" "HOLOTYPE // *Eosphaerophoria* // *adornata* // det. X. Mengual 20*09*" [red, second and third lines handwritten] USNM ENT00036560 [1♀, BPBM]. ***Paratype:*** "NEW GUINEA: PAPUA // Normanby I. // Wakaiuna, Sewa Bay // Oct. 25-30-1956' "W.W. Brandt // Collector" "PARATYPE // *Eosphaerophoria* // *adornata* // det. X. Mengual 20*09*" [yellow, second and third lines handwritten] USNM ENT00036561 [1♀, USNM].

Length (2): body, 6.5–6.6 (6.6) mm; wing, 4.8–5.0 (4.9) mm.

Distribution: Papua New Guinea.

Etymology. The specific epithet is derived from the Latin *adornatus* meaning decorated, embellished (Brown 1956: 577), and it refers to the medial tooth present on the posterior margin of the scutellum. Species epithet to be treated as adjective.

Differential diagnosis. *Eosphaerophoria adornata* is one of the largest species of this genus. It is easily recognized by the tooth on the scutellum, a character shared with



Figures 11–20. 11–13, *Giluwea flavomacula* (from Vockeroth 1969): **11** lateral view of male head **12** dorsal view of male head **13** wing showing costal swelling. **14–15** *Rhinobaccha gracilis*: **14** lateral view of male **15** dorsal view of male head **16** *Allograpta obliqua*, lateral view of male genitalia showing the superior lobe fused with hypandrium (from Vockeroth 1969) **17** *Exallandra cinctifacies*, lateral view of male genitalia (from Vockeroth 1969) **18** *Sphaerophoria novaeangliae*, lateral view of male genitalia (from Vockeroth 1969) **19** *Eosphaerophoria marginata*, frontal view of male head **20** *Eosphaerophoria vietnamensis*, frontal view of male head.

E. dentiscutellata and *E. hermosa*. It can be separated from *E. hermosa* by having the face entirely yellow. *E. adornata* differs from *E. dentiscutellata* in having a yellow fascia on 2nd and 5th abdominal terga, while the latter has the 2nd tergum black with lateral margin yellow and 5th tergum with two lateral yellow maculae (see Figs 13 and 14).

***Eosphaerophoria bifida* Mengual, sp. n.**
urn:lsid:zoobank.org:act:CC72B15F-EB91-49C0-8B29-100D2E5D39E1
Figs 24, 37, 44; MorphBank [http://www.morphbank.net/?id=478062]

Vockeroth 1969: 135 as *Eosphaerophoria* sp. (citation).

Male. *Head*. Face straight, with distinct round tubercle, yellow, yellow pilose; gena yellow, yellow pilose; lunula black; frons completely black on dorsal 2/3 (length between anterior ocellus and lunula), yellow on basolateral 1/3 with medial broad black vitta, about 1/2 of the facial width, yellow pilose on yellow areas with some dark pile on black areas, with distinct round tubercle at medial section between anterior ocellus and lunula; dichoptic; vertex and vertical triangle black, dark pilose; ocelli brownish; antenna light brown to dark yellow, darker than face, basoflagellomere brown, darker dorsally, oval; arista dark brown; occiput mainly black, yellow ventrally, yellow pilose and silvery pollinose ventrally, and dark pilose and golden pollinose dorsally, no pile seen at medial section.

Thorax. Scutum black, shiny medially, black pollinose laterally, golden brown pilose, yellow laterally with lateral yellow vitta from postpronotum to scutellum, narrower between transverse suture and postalar callus with ventral black area; postpronotum yellow; notopleuron yellow with distinct posterolateral obtuse protuberance; scutellum triangular, yellow with dorsomedial triangular black area continuing from posterior mesonotum, brownish pilose; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter yellow. *Wing*. Wing bare basomedially.

Legs. Pro- and mesoleg entirely yellow, except distal part of mesofemur and basal part of mesotibia darker, mesocoxa darker, and pro- and mesotarsus slightly darker, yellow pilose except tarsi with short black setulae ventrolaterally; metacoxa and trochanter yellow; metafemur yellow on basal 1/3, black on distal 2/3, brownish pilose; metatibia black, black pilose; metatarsus black, golden pilose ventrolaterally.

Abdomen. Fig. 37. Dorsum mainly black, dorsally black pilose except 1st tergum and anteriorly 2nd tergum yellow pilose laterally; 1st tergum black with anterior and lateral yellow margin, medially reaching anterior margin of 2nd tergum dividing the black area in 2 triangular maculae; 2nd tergum black dorsally with medial elongated yellow macula, yellow laterally on basal 3/4 continuing the yellow margin of 1st tergum; 3rd tergum black with basoanterior very narrow black fascia not reaching margins and with basal yellow fascia, about 1/5–1/4 of tergum length, produced posteriorly in a long triangular emargination reaching 2/3 length of tergum, with lateral margin yellow on anterior 4/5; 4th tergum similar to 3rd but posteromedial yellow emargination looks shorter because the tergum is shorter; 5th tergum black with anterior narrow black fascia not reaching lateral margin, with 2 lateral narrow triangular yellow maculae joining medially forming very narrow yellow fascia, laterally yellow on basal 1/3; sterna yellowish, yellow pilose except 4th sternum with posterior margin black pilose medially; male genitalia as figured (Fig. 44).

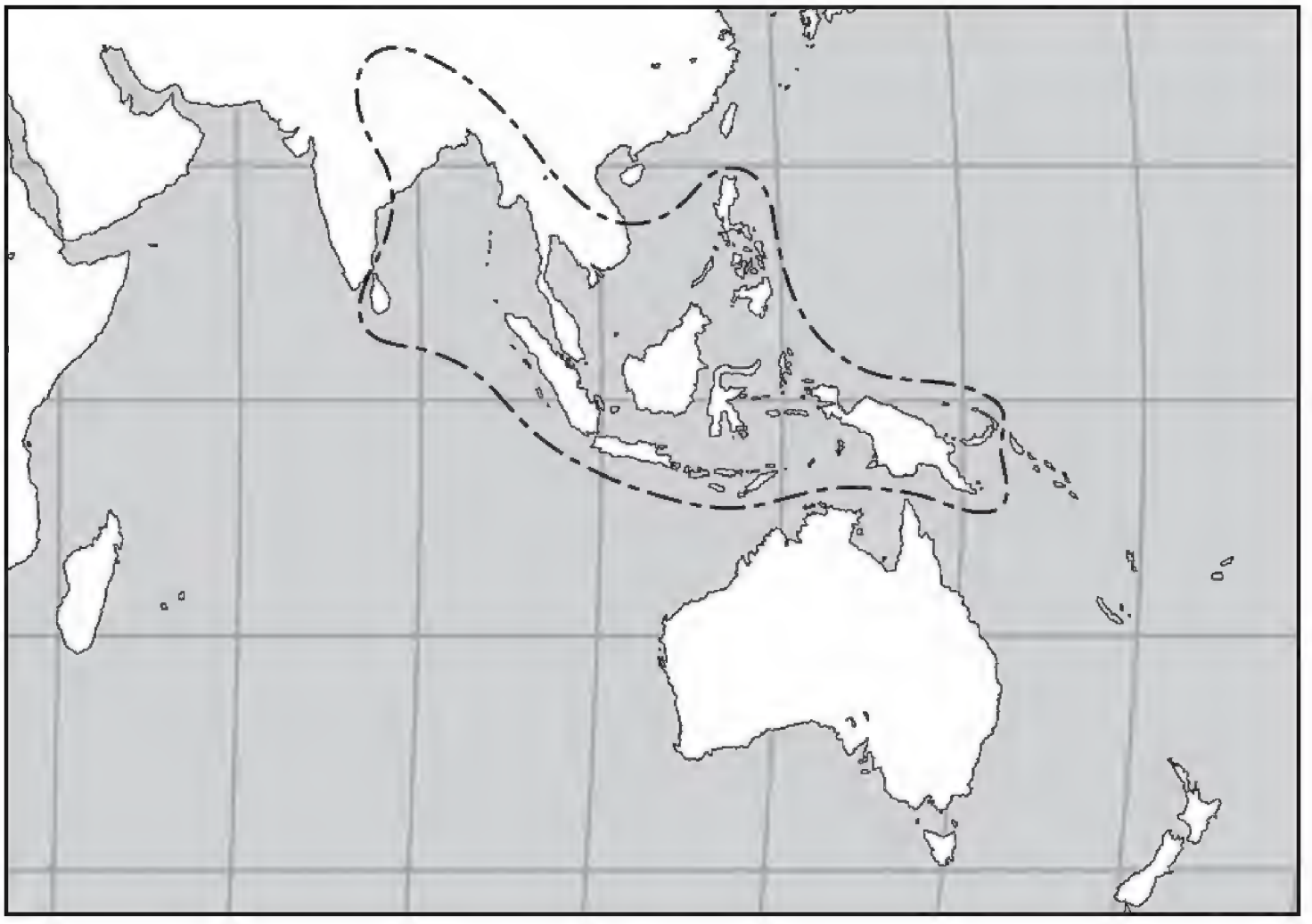


Figure 21. World distribution of *Eosphaerophoria* Frey, 1946, an estimate. The dotted line indicates that insufficient information is available and that the limit shown is only an approximation defined by collecting points. Adapted from Vockeroth (1969).

Female. Unknown.

Type locality. PAPUA NEW GUINEA: Morobe, Bulolo, Wau. 7°20'30.51"S 146°42'15.98"E.

Type. ***Holotype***: "New Guinea // Wau, 1250 m // 20.VIII.1965" "Malaise Trap // J&M. Sedlacek // BISHOP" "HOLOTYPE // *Eosphaerophoria* // *bifida* // det. X. Mengual 20*09*" [red, second and third lines handwritten] USNM ENT00036558 [1♂, BPBM].

Length (1): body, 5.7 mm; wing, 4.2 mm.

Distribution: Papua New Guinea.

Etymology. The specific epithet refers to the shape of surstylus in male genitalia, which presents the distal margin divided in two lobules posteriorly (see Fig. 44c), and it is from the Latin *bifidus* meaning split into two parts, bifurcated (Brown 1956: 345). Species epithet to be treated as adjective.

Differential diagnosis. Species easy to identify by an elongated yellow macula on 2nd abdominal tergum and the face entirely yellow. It has the male genitalia similar to *E. luteofasciata*, especially the bifurcated surstylus. The surstylus of *E. bifida* has two lobes of different sizes (Figs 44a, 44c) but *E. luteofasciata* has the surstylus divided in two similar lobes in lateral view (Figs 47a, 47d). Moreover, *E. bifida* has superior lobes with conical shape and *E. luteofasciata* has them expanded anteroventrally.

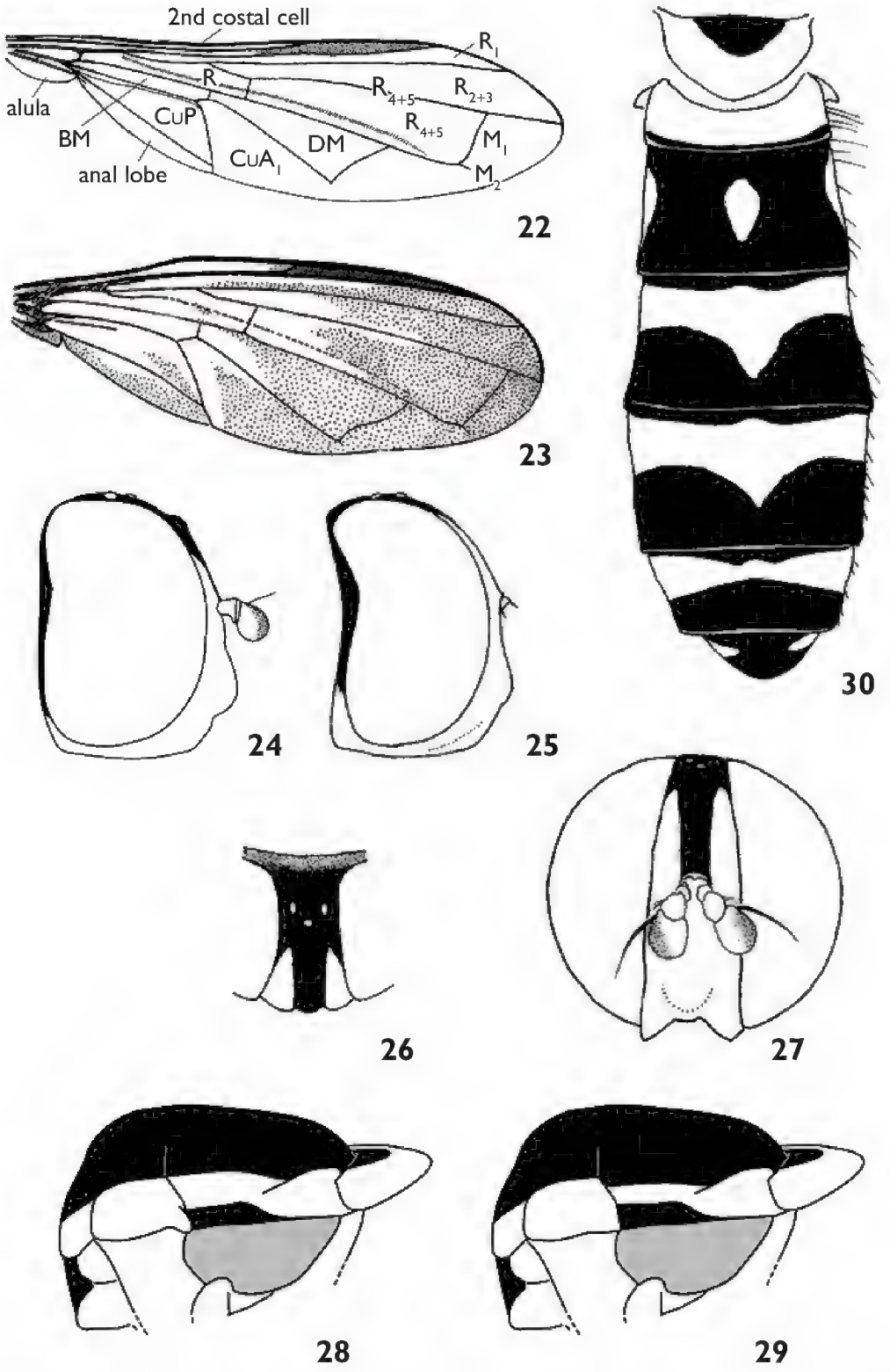
Remarks. *Eosphaerophoria bifida* is described based on a single male from Wau (Papua New Guinea). *Eosphaerophoria bifida* could be the male of *E. nigrovittata* that is described from two females, holotype also from Wau. There are differences between both species. *E. bifida* has an all yellow face, but *E. nigrovittata* has a medial broad black facial vitta. However, this character does show dimorphic variation (for example see *E. marginata*), but in this case is much more divergent. *Eosphaerophoria bifida* has a yellow macula on 2nd tergum and *E. nigrovittata* does not or it is not clear (see comments about variation of *E. nigrovittata*). In species with both sexes known, such as *E. marginata* and *E. vietnamensis*, the abdominal pattern does not display significant differences. The fact that both species, *E. bifida* and *E. nigrovittata*, were collected in the same region but in different years is not an argument to consider them the same taxon, because there is an example of different species collected from the same place and the same date, *E. vietnamensis* and *E. symmetrica*. Based on this, we consider *E. bifida* and *E. nigrovittata* as being different species.

***Eosphaerophoria brunettii* Ghorpadé, sp. n.**
urn:lsid:zoobank.org:act:42A2E387-76AE-4450-B52F-141942F857A8
Figs 29, 38, 45; MorphBank [http://www.morphbank.net/?id=478077]

Male. *Head.* Face straight, with distinct round tubercle, more prominent than in *E. marginata*, yellow; gena yellow, yellow pilose; lunula black; frons completely black on dorsal 3/8 (length between anterior ocellus and lunula), yellow on basolateral 6/8 with medial black vitta, about 1/4–1/3 of facial width, with frontal sulcus defining the dorsal completely black area, yellow pilose; dichoptic; vertex and vertical triangle black; ocelli brownish; antenna light brown to yellow, basoflagellomere darker dorsally, oval; arista brown; occiput mainly black, yellow ventrally, grey pollinose, yellow pilose.

Thorax. Scutum black, shiny medially, black pollinose laterally, golden brown pilose, yellow laterally with lateral narrow yellow stripe from transverse suture to scutellum, narrower than notopleuron and with black areas dorsally and ventrally, being located in a central position to notopleuron (Fig. 29); postpronotum yellow; notopleuron yellow without obtuse protuberance or at least not distinct as in *E. marginata*; scutellum triangular, yellow with dorsomedial triangular black area continuing from posterior mesonotum, brownish pilose; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter yellowish. *Wing*. Wing bare basomedially.

Legs. Pro- and mesoleg entirely yellow, except distal part of mesofemur and basal part of mesotibia dark, mesocoxa dark, yellow pilose except tarsi with short black setulae ventrolaterally; metacoxa and trochanter yellow; metafemur yellow on basal 1/3, black on distal 2/3, with ventral short strong black spine-like setulae on the apical 2/3; metatibia black, black pilose; metatarsus black, black pilose dorsolaterally and golden pilose ventrolaterally.



Figures 22–30. 22 *Eosphaerophoria marginata*, wing (from Vockeroth 1969); cells in black, veins in red **23** *Eosphaerophoria punctata*, wing (from Claussen and Weipert 2003) **24** *Eosphaerophoria bifida*, lateral view of head **25–27** *Eosphaerophoria punctata* (from Claussen and Weipert 2003) **25** lateral view of head **26** dorsal view of head **27** frontal view of head **28** *Eosphaerophoria marginata*, lateral view of thorax **29** *Eosphaerophoria brunettii*, lateral view of thorax **30** *Eosphaerophoria punctata*, dorsal view of abdomen and scutellum (from Claussen and Weipert 2003).

Abdomen. Fig. 38. Dorsum mainly black, dorsally black pilose, 1st, 2nd and 3rd terga laterally yellow pilose; 1st tergum yellow with posterodistal narrow black fascia not reaching margins joined to lateral small brownish maculae, yellow laterally; 2nd tergum black dorsally, yellow laterally on basal 1/2 continuing the yellow margin of 1st tergum; 3rd tergum black with basoanterior very narrow black fascia not reaching margins and with basal yellow fascia, about 1/3 tergum length, produced posteriorly

in a medial triangular emargination reaching half length of tergum, with lateral margin yellow on anterior 1/2; 4th tergum similar to 3rd but yellow fascia slightly broader; 5th tergum black with 2 lateral triangular yellow maculae on basal 1/3, leaving the median 1/3 black; 6th tergum black, yellow laterally; sterna yellowish brown; male genitalia as figured (Fig. 45).

Female. Unknown.

Type locality. MALAYSIA: Pahang, Titiwangsa Mountains, Fraser's Hill. 3°42'59.16"N 101°44'30.35"E.

Type. ***Holotype:*** "FRASERS HILL // Malaya, 4,000 ft. // P. A. Buxton // 14. Feb. 1954" "Pres. by // P.A. Buxton. // B.M.1954-693" "BMNH" "Loan # // 11849" "*Eosphaerophoria // sp. nov.* // ♂ // K.D. Ghorpade det.19*83*" [handwritten except fourth line] "HOLOTYPE // *Eosphaerophoria // brunettii* // det. X. Mengual 20*09*" [red, second and third lines handwritten] USNM ENT00036557 [1♂, BMNH].

Length (1): body, 5.4 mm; wing, 4.0 mm.

Distribution: Malaysia.

Etymology. The specific epithet refers to Enrico Brunetti (1862–1927), an amateur entomologist and professional musician of Italian-British extraction who lived 17 years in India working part time on the taxonomy of Oriental (mainly Indian subcontinent) Diptera at the Indian Museum in Calcutta (now with the Zoological Survey of India) with the encouragement of its then director, Nelson Annandale. This new species is dedicated to him for his exhaustive research on Indian and Malayan Syrphidae and many other Diptera, this giving me (KG) my first guidance and stimulus for pursuing my own studies. Species epithet to be treated as a noun in the genitive case.

Differential diagnosis. Very distinct species with a characteristic lateral yellow mesonotal vitta, narrower and centred after transverse suture (see Fig. 29), notopleuron not produced posterolaterally and with male genitalia very recognizable (Fig. 45).

Remarks. Due to the position of the legs in the pinned specimen, it was not possible to know if metafemur possesses 1 or 2 ventral rows of black spine-like setulae. Based on the experience with other species of this genus and other genera, there probably are 2 rows of short strong black setulae.

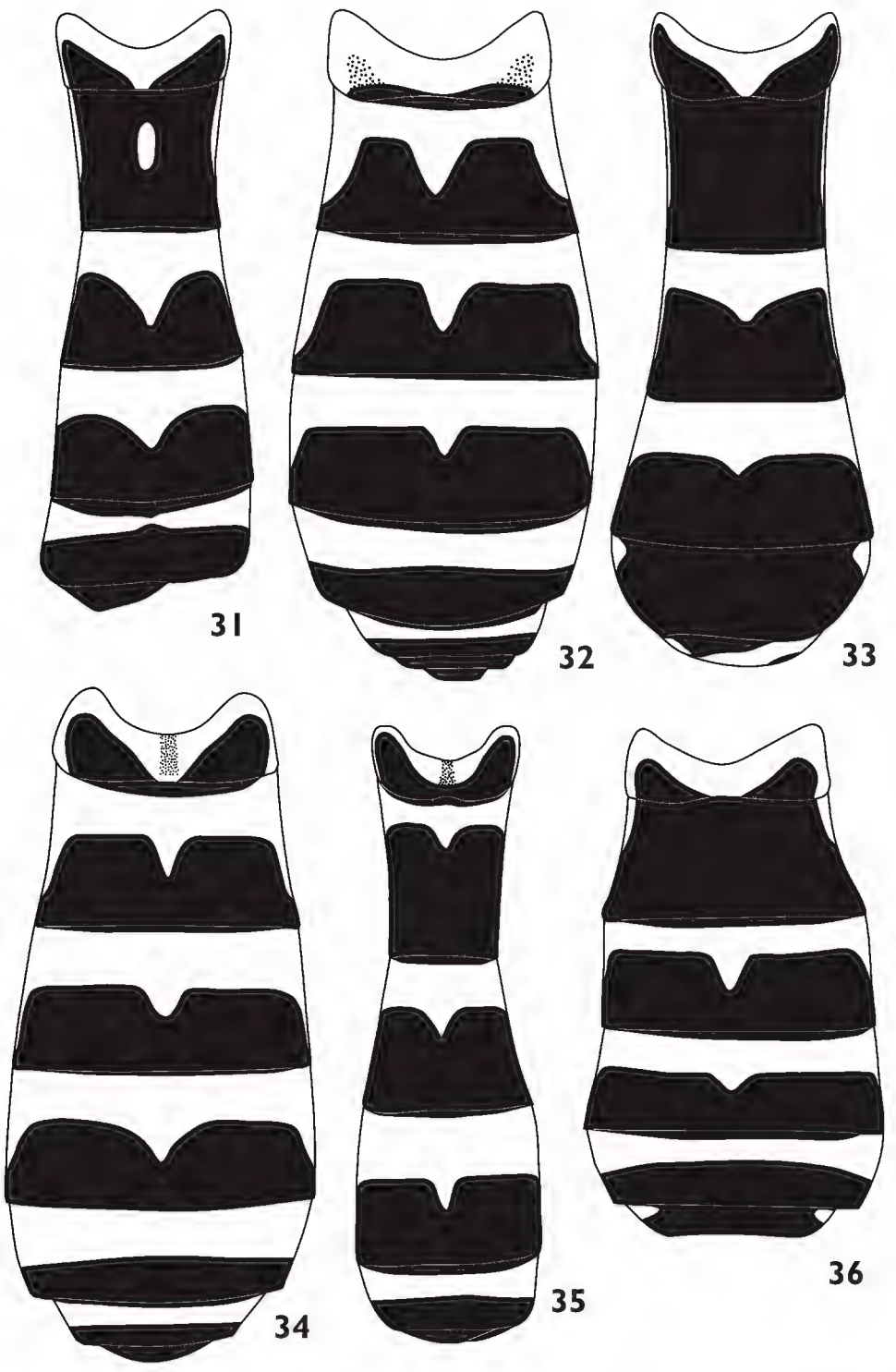
Eosphaerophoria dentiscutellata (Keiser, 1958)

Figs 33, 46; MorphBank [http://www.morphbank.net/?id=478078]

Tambavanna dentiscutellata Keiser, 1958: 202. Type locality: Sri Lanka, Kandy, Deiyannewela. Holotype 1♂ [NMB, Basel]. Keiser, 1958: 202, Fig. 3 (habitus, head, wing).

Eosphaerophoria dentiscutellata Vockeroth, 1969: 135 (new combination, species misidentified from Vietnam); Knutson et al. 1975: 313 (catalog citation); Ghorpadé 1994: 5 (key reference, citation). Claussen and Weipert 2003: 354 (identification key).

Male. *Head.* Face straight, narrow becoming broader ventrally (about 1/20 of head width at antennal basis), with distinct round tubercle, yellow, yellow pilose; gena yel-



Figures 31–36. Abdomen, dorsal view: **31** *Eosphaerophoria symmetrica*, male **32** *E. hermosa*, female **33** *E. dentiscutellata*, male **34** *E. adornata*, female **35** *E. luteofasciata*, male **36** *E. nigrovittata*, female.

low; lunula yellow; frons completely black on dorsal 1/4–1/3 (length between anterior ocellus and lunula), yellow on ventral 2/3–3/4, with frontal sulcus defining the dorsal completely black area, with few yellow and dark hairs; dichoptic; vertex and vertical triangle black, black pilose; ocelli brownish; antenna yellow, basoflagellomere brown dorsally, oval; arista brown; occiput mainly black, yellow ventrally, yellow pilose and silvery pollinose ventrally, black pilose and golden pollinose dorsally.

Thorax. Scutum mainly black, shiny medially, black pollinose laterally, yellow laterally with lateral broad yellow stripe from postpronotum to scutellum, narrower after transverse suture with ventral black area, golden brown pilose; postpronotum yellow; notopleuron yellow with distinct posterolateral obtuse protuberance; scutellum triangular, with a tooth on medial posterior margin, yellow with dorsomedial triangular

black area continuing from posterior mesonotum, golden brown pilose; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter yellowish. *Wing*. Wing bare basomedially.

Legs. Pro- and mesoleg entirely yellow, except probasitarsomere slightly brownish laterodorsally, and distal part of mesofemur and basal part of mesotibia slightly darker, yellow pilose except tarsi with short black setulae ventrolaterally; metacoxa and trochanter yellow, yellow pilose; metafemur yellow on basal 1/2, black on distal 1/2, yellow and brown pilose, with 2 ventral rows (anteroventral and posteroventrally) of short strong black spine-like setulae on the apical 2/3; metatibia black, golden brown pilose; metatarsus black, golden yellow and brown pilose.

Abdomen. Fig. 33. Dorsum mainly black, black pilose except 1st tergum and anteriorly 2nd tergum yellow pilose laterally; 1st tergum black with anterior and lateral yellow margin, medially reaching the anterior margin of 2nd tergum dividing the black area in 2 triangular maculae; 2nd tergum black dorsally, narrowly yellow laterally on basal 3/4 continuing the yellow margin of 1st tergum; 3rd tergum black with basomedial very narrow black fascia not reaching margins and with basal yellow fascia, about 1/4–1/3 of tergum length, becoming broader medially and ending in a posteriorly pointed emargination at medial point, yellow on anterior 3/5 of lateral margin; 4th tergum black with basal yellow fascia slightly broader, about 1/3–1/2 of tergum length, produced posteriorly in a small triangular emargination, yellow on anterior 1/2 of lateral margin; 5th tergum black with 2 lateral small rounded yellow maculae on basal 1/3; 6th tergum black, yellow laterally; 7th tergum yellow; 8th tergum yellow with medial black macula; sterna yellow, yellow pilose except 4th sternum with some long thin black hairs medially and genital segments brown pilose; 3rd sternum with posterior margin slightly produced medially with black setulae; 4th sternum with posterior margin produced medially into 2 projections with black setulae; male genitalia as figured (Fig. 46).

Female. Unknown.

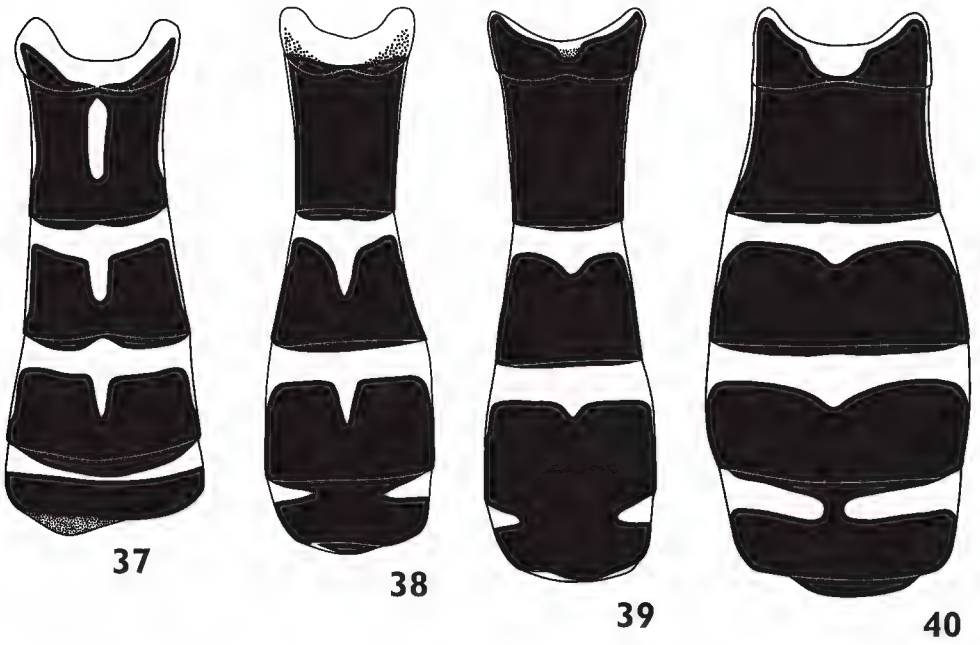
Type locality. SRI LANKA: Central Province, Kandy, Deiyannewela. 7°17'7.10"N 80°37'54.71"E.

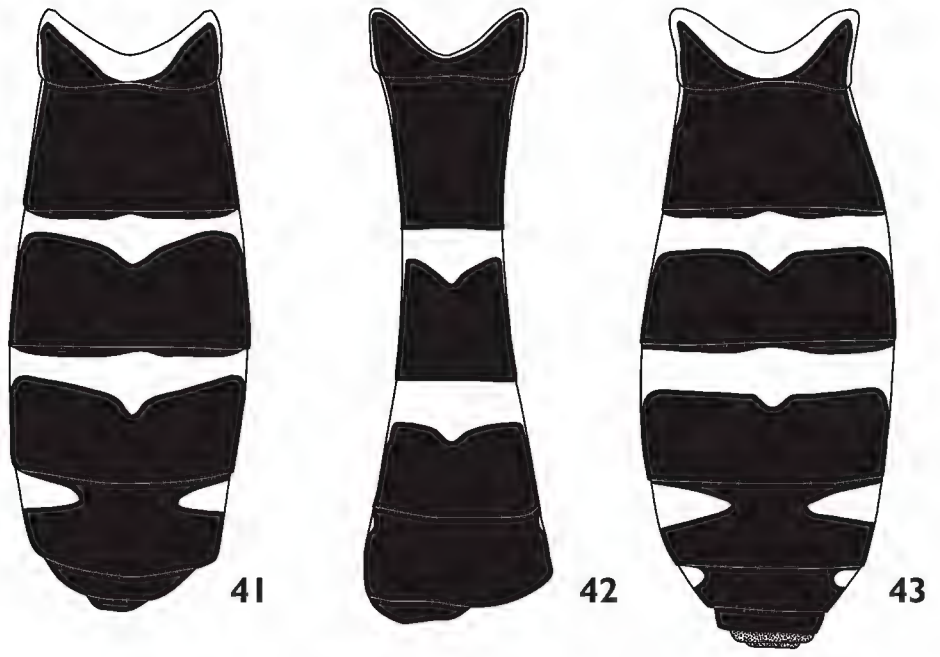
Type. ***Holotype:*** "CEYLON C.P. // Kandy // Deiyannewela // 17.X.53F. Keiser" "TYPUS" "*Tambavanna denstiscutellata*" [handwritten] "HOLOTYPE // *Eosphaerophoria* // *dentiscutellata* // det. X. Mengual 2009" [red, second and third lines handwritten] USNM ENT00036542 [1♂, NMB].

Length (1): body, 5.5 mm; wing, 4.1 mm.

Distribution: Sri Lanka.

Differential diagnosis. Species characterized by a medial tooth in the posterior margin of the scutellum, like *E. adornata* and *E. hermosa* (see comments above). *Eosphaerophoria dentiscutellata* differs from *E. hermosa* in having a medial black facial vitta, and from *E. adornata* in having 2nd tergum black with lateral margin yellow and 5th tergum with two lateral yellow maculae (see Figs 13 and 14). Its male genitalia is similar similar to the genitalia of *E. vietnamensis*, both with asymmetrical superior





Figures 37–43. Abdomen, dorsal view: **37** *Eosphaerophoria bifida*, male **38** *E. brunettii*, male **39** *E. marginata*, male **40** *E. marginata*, paralectotype female **41** *E. marginata*, Thailand female **42** *E. vietnamensis*, male **43** *E. vietnamensis*, female.

lobes like in *E. marginata*, but *E. dentiscutellata* has superior lobe slightly larger and different surstylus shape (see Figs 46, 48, 50).

Eosphaerophoria hermosa Mengual, sp. n.

urn:lsid:zoobank.org:act:3437D78B-8A38-451B-B270-DE9AE95FE239
Fig. 32; MorphBank [http://www.morphbank.net/?id=478079]

Male. Unknown.

Female. *Head.* Face straight, broad, with distinct round tubercle, yellow with medial diffuse black vitta narrowing to tubercle tip not reaching oral apex, yellow pilose; gena yellow; lunula black; frons completely black on dorsal 1/4 (length between

anterior ocellus and lunula), yellow on basolateral 3/4 with medial well-defined black vitta slightly narrowing ventrally (about 1/3 of frons width) continuing with facial vitta, yellow pilose; vertex and vertical triangle black, black pilose; ocelli brownish, anterior ocellus very small; antenna yellow, basoflagellomere brown dorsally, oval; arista brown; occiput mainly black, yellow ventrally, yellow pilose and silvery pollinose ventrally, black pilose and golden pollinose dorsally.

Thorax. Scutum mainly black, shiny medially, black pollinose laterally, yellow laterally with lateral broad yellow stripe from postpronotum to scutellum, narrower after transverse suture with ventral black area, golden brown pilose; postpronotum yellow; notopleuron yellow with distinct posterolateral obtuse protuberance; scutellum triangular, with a tooth on medial posterior margin, yellow with dorsomedial triangular black area continuing from posterior mesonotum, golden brown pilose; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter yellowish. *Wing*. Wing bare basomedially.

Legs. Pro- and mesoleg entirely yellow, except distal part of mesofemur and basal part of mesotibia slightly darker, yellow pilose except tarsi with short black setulae ventrolaterally; metacoxa and trochanter yellow, yellow pilose; metafemur yellow on basal 1/2, black on distal 1/2, yellow and brown pilose; metatibia black, golden brown pilose; metatarsus black, golden yellow pilose ventrolaterally and brown pilose dorsolaterally.

Abdomen. Fig. 32. Dorsum mainly black, black pilose except 1st tergum yellow pilose laterally; 1st tergum yellow with posteromedial very narrow black fascia not reaching margins; 2nd tergum black dorsally, with anteromedial very narrow black fascia not reaching margins and basal yellow fascia, about 1/4 of tergum length, produced posteriorly in a medial triangular emargination reaching half length of tergum, with lateral margin broadly yellow on anterior 4/5, as broad as anterobasal yellow fascia; 3rd tergum black with basomedial very narrow black fascia not reaching margins and with basal yellow fascia, about 1/3 of tergum length, produced posteriorly in a medial triangular emargination reaching 2/3 length of tergum, with lateral margin yellow on anterior 3/4; 4th tergum similar to 3rd tergum, black with basomedial very narrow black fascia not reaching margins and with basal yellow fascia, about 1/3 of tergum length, produced posteriorly in a medial triangular emargination reaching half length of tergum, with lateral margin yellow on anterior 2/3; 5th tergum black with basomedial very narrow black fascia not reaching margins and with a basal yellow fascia, about 1/2 of tergum length, slightly broader laterally and narrower medially; 6th tergum similar to 5th tergum, black with basomedial broad black fascia and with basal yellow fascia, about 2/5 of tergum length; 7th and 8th terga black; sterna yellowish, black pilose; 4th sternum with some depressed long thin black hairs medially on posterior margin; 5th, 6th and7th terga with some long erected thin black hairs medially on posterior margin.

Type locality. INDONESIA: North Maluku, Jailolo, Halmahera Island, Kampung Pasir Putih. 0°53'N, 127°41'E. The coordinates place the collecting point in the sea

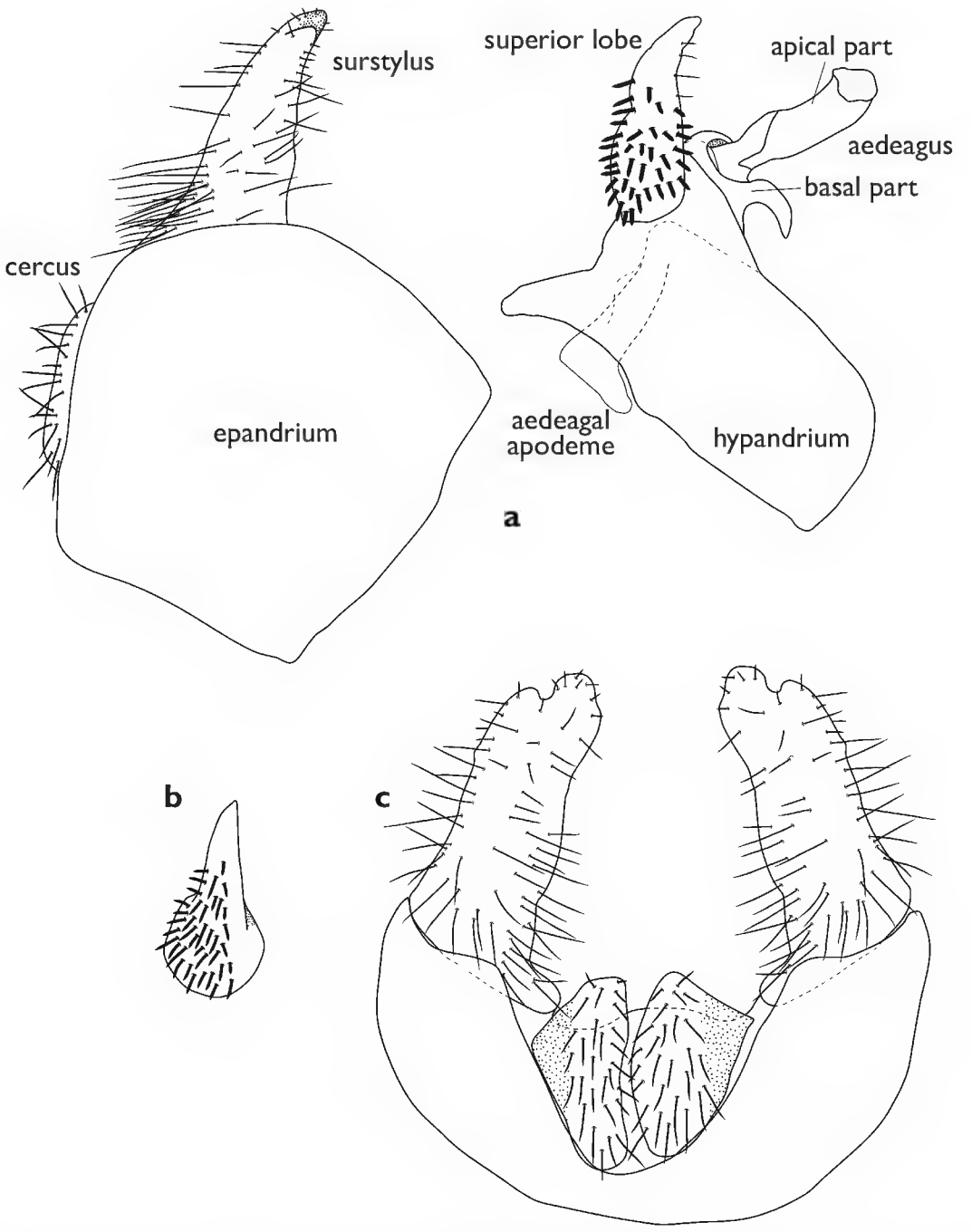


Figure 44. *Eosphaerophoria bifida*, male genitalia: **a** left lateral view **b** right superior lobe, dorsal view **c** tergite 9, cerci and surstyli, dorsal view.

due to the planetary model used, but it was moved to the closest terrestrial point in the kml file.

Type. ***Holotype:*** "INDONESIA:Halmahera // Isl.,Jailolo Dist., // Kampung Pasir Putih // 0°53'N, 127°41'E" "1–14 Feb. 1981 // AC Messer & PM Taylor" "HOLOTYPE // *Eosphaerophoria* // *hermosa* // det. X. Mengual 20*09*" [red, second and third lines handwritten] USNM ENT00036562 [1♀, USNM].

Length (1): body, 6.8 mm; wing, 5.0 mm.

Distribution: Indonesia.

Etymology. The specific epithet is derived from the Spanish *hermoso*, meaning beautiful, comely, handsome. Species epithet to be treated as adjective.

Differential diagnosis. *Eosphaerophoria hermosa*, *E. dentiscutellata* and *E. adornata* are the three species with a distinct medial tooth on the posterior scutellar margin. *Eosphaerophoria hermosa* has a medial black facial vitta, while the other species have

yellow faces and most of the 1st abdominal tergum yellow. In addition, its abdominal pattern is the mostly yellow.

***Eosphaerophoria luteofasciata* Mengual, sp. n.**
urn:lsid:zoobank.org:act:4DAAAC30-BBC4-4EF4-B6B1-7AF92BFDCDA2
Figs 35, 47; MorphBank [http://www.morphbank.net/?id=478080]

Vockeroth, 1969: 135 as *Eosphaerophoria* sp. (citation).

Male. *Head*. Face straight, with distinct round tubercle, yellow, yellow pilose; gena yellow, yellow pilose; lunula blackish medially; frons completely black on dorsal 3/5 (length between anterior ocellus and lunula), yellow on basolateral 2/5 with medial black vitta abruptly narrowed during dorsal 1/5 becoming medial very narrow simple black line during ventral 1/5 reaching lunula, with frontal sulcus about medial point between lunula and anterior ocellus, defined dorsally with a tubercle elevating vertex and with a ventral depression, yellow pilose in yellow areas and dark pilose in black areas; dichoptic; vertex and vertical triangle black; ocelli brownish; antenna yellow, basoflagellomere yellow with dorsal brown macula, oval; arista brown; occiput mainly black, yellow ventrally, silvery pollinose and yellow pilose on ventral 1/3, black pilose on dorsal 2/3 and golden pollinose on dorsal 1/3.

Thorax. Scutum black, shiny medially, black pollinose laterally, golden brown pilose with yellow pile on notopleuron, yellow laterally with lateral yellow stripe from postpronotum to scutellum, narrower after transverse suture with ventral black area; postpronotum yellow; notopleuron yellow with distinct posterolateral obtuse protuberance; scutellum triangular, pointed posteriorly with small blunt tubercle on medial posterior margin, yellow with dorsomedial triangular black area continuing from posterior of mesonotum, brownish pilose; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with a dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter yellowis). *Wing*. Wing bare basomedially.

Legs. Pro- and mesoleg entirely yellow, except distal part of mesofemur and basal part of mesotibia dark, yellow pilose except tarsi with short black setulae ventrolaterally; metacoxa and trochanter yellow; metafemur yellow on basal 1/3, black on distal 2/3; metatibia black, black pilose; metatarsus black, black pilose dorsolaterally and golden pilose ventrolaterally.

Abdomen. Fig. 35. Dorsum mainly black, dorsally black pilose, 1st tergum laterally yellow pilose; 1st tergum black with anterior and lateral yellow margin, medially reaching anterior margin of 2nd tergum dividing black area in 2 triangular maculae; 2nd tergum black with basomedial very narrow black fascia not reaching margins and with basal yellow fascia, about 1/5 of tergum length, produced posteriorly in a medial triangular emargination reaching 1/3 length of tergum, yellow on anterior 1/3 of lateral margin; 3rd tergum black with basomedial very narrow black fascia not reaching

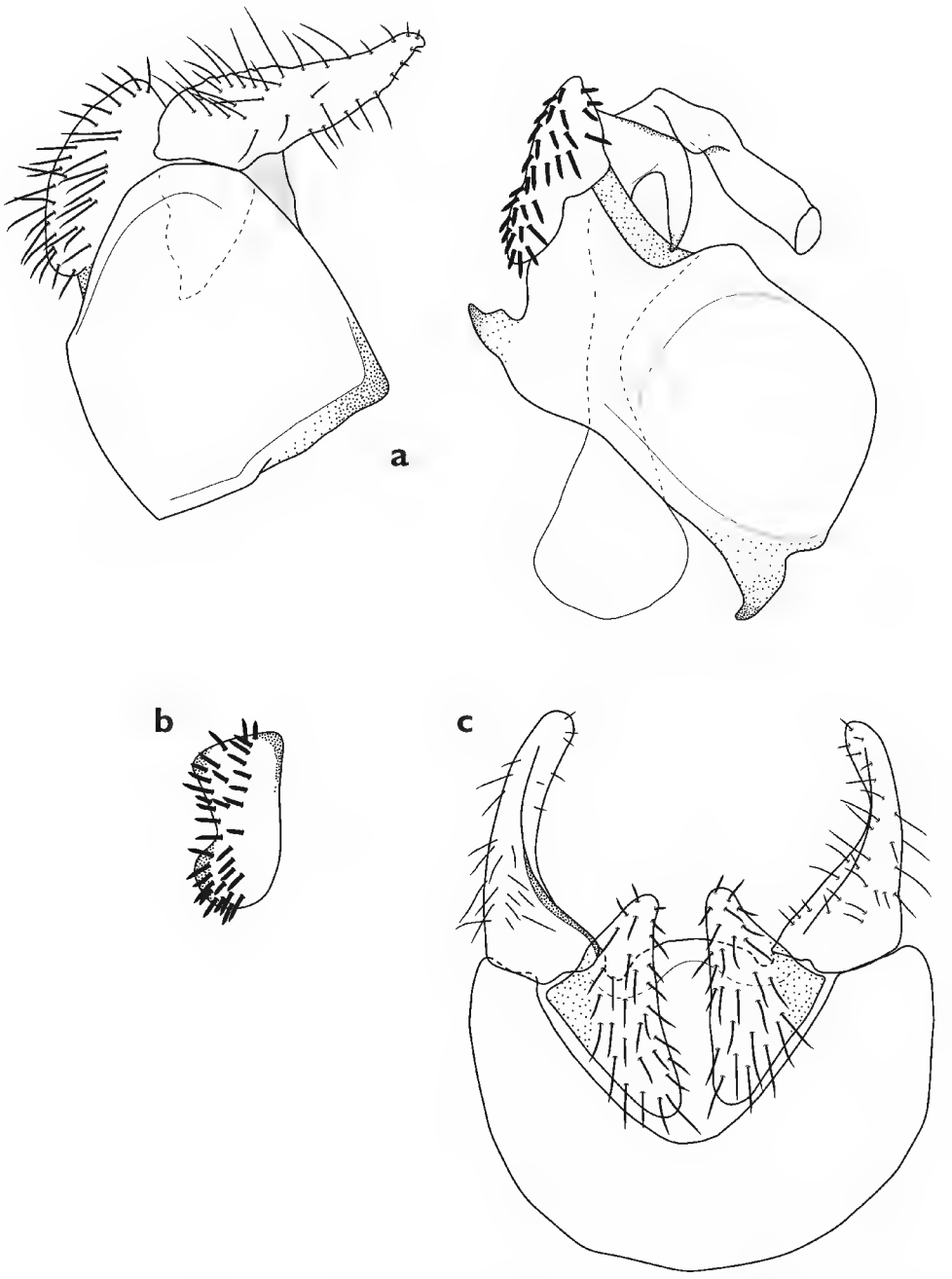


Figure 45. *Eosphaerophoria brunettii*, male genitalia **a** left lateral view **b** right superior lobe, dorsal view **c** tergite 9, cerci and surstyli, dorsal view.

margins and with basal broad yellow fascia, about 1/3 of tergum length, produced posteriorly in a medial triangular emargination reaching 1/2 length of tergum, yellow on anterior 1/3 of lateral margin; 4th tergum similar to 3rd, black with basomedial very narrow black fascia not reaching margins and with basal yellow fascia, about 2/5 of tergum length, produced posteriorly in a medial triangular emargination reaching 2/3 length of tergum, yellow on anterior 2/5 of lateral margin; 5th tergum black with basomedial very narrow black fascia and with basal broad yellow fascia, about 1/2 length tergum; 6th and 7th terga black; sterna yellowish, brownish pilose; male genitalia as figured (Fig. 47).

Female. Unknown.

Type locality. PAPUA NEW GUINEA: New Ireland, Kaveing, Schleinitz Mountains, Lelet Plateau. 3°20'0.00"S 152°0'0.00"E.

Type. ***Holotype:*** "NEW IRELAND // Schleinitz Mts. // Lelet Plateau // Oct. 1959" "W. W. Brandt // Collector // BISHOP" "HOLOTYPE // *Eosphaerophoria*

// *luteofasciata* // det. X. Mengual 2009" [red, second and third lines handwritten] USNM ENT00036555, [1♂, BPBM].

Length (1): body, 6.3 mm; wing, 4.7 mm.

Distribution: Papua New Guinea.

Etymology. The specific epithet is derived from the Latin *luteus* meaning yellow (Brown 1956: 872), and the Latin *fasciatus* meaning envelope with bands, swathe (Brown 1956: 138), and it refers to the yellow fascia (band) on the 2nd abdominal tergum. Species epithet to be treated as adjective.

Differential diagnosis. Species with a characteristic yellow fascia on 2nd abdominal tergum, also present in *E. hermosa* and *E. adornata*, but differs from them in the absence of a tooth on the posterior margin of the scutellum. *E. luteofasciata* has posteriorly pointed scutellum, but without tooth or blunt protuberance. Male genitalia with bifurcated surstylus, divided in two similar lobes in lateral view (Figs 47a, 47d), very similar to the male genitalia of *E. bifida*, whose surstylus has two lobes of different sizes (Figs 44a, 44c).

Remarks. Vockeroth (1969: 135) mentioned this species as undescribed.

Eosphaerophoria marginata Frey, 1946

Figs 22, 28, 39, 40, 41, 48; MorphBank [http://www.morphbank.net/?id=478081]

Eosphaerophoria marginata Frey, 1946: 169. Type locality: Philippines, Luzon, Mt. Banahao. Syntypes 3♂1♀. Lectotype ♂ here designated [ZMUH, Helsinki]. Claussen and Weipert 2003: 354, Figs 34 (abdomen), 38 (scutum and scutellum, ♀).

Male. *Head*. Face straight, with distinct round tubercle, yellow, yellow pilose; gena yellow; lunula black; frons completely black on dorsal 1/2 (length between anterior ocellus and lunula), yellow on basolateral 1/2 with medial black vitta narrowing ventrally, about 1/3 of the facial width at the narrowest point, with frontal sulcus defining dorsal completely black area, with few short yellow hairs ventrally; dichoptic; vertex and vertical triangle black; ocelli brownish; antenna yellow, basoflagellomere darker dorsally, oval; arista dark brown; occiput mainly black, yellow ventrally, yellow pilose.

Thorax. Scutum mainly black, shiny medially, black pollinose laterally, yellow laterally with a lateral broad yellow stripe from postpronotum to scutellum with some black hairs, golden brown pilose; postpronotum yellow; notopleuron yellow with distinct posterolateral obtuse protuberance; scutellum triangular, yellow with dorsomedial triangular black area continuing from posterior mesonotum, brownish pilose; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter orangish yellow. *Wing*. Wing bare basomedially.

Legs. Pro- and mesoleg entirely yellow, except distal part of mesofemur and basal part of mesotibia dark, yellow pilose except tarsi with short black setulae ventrolater-

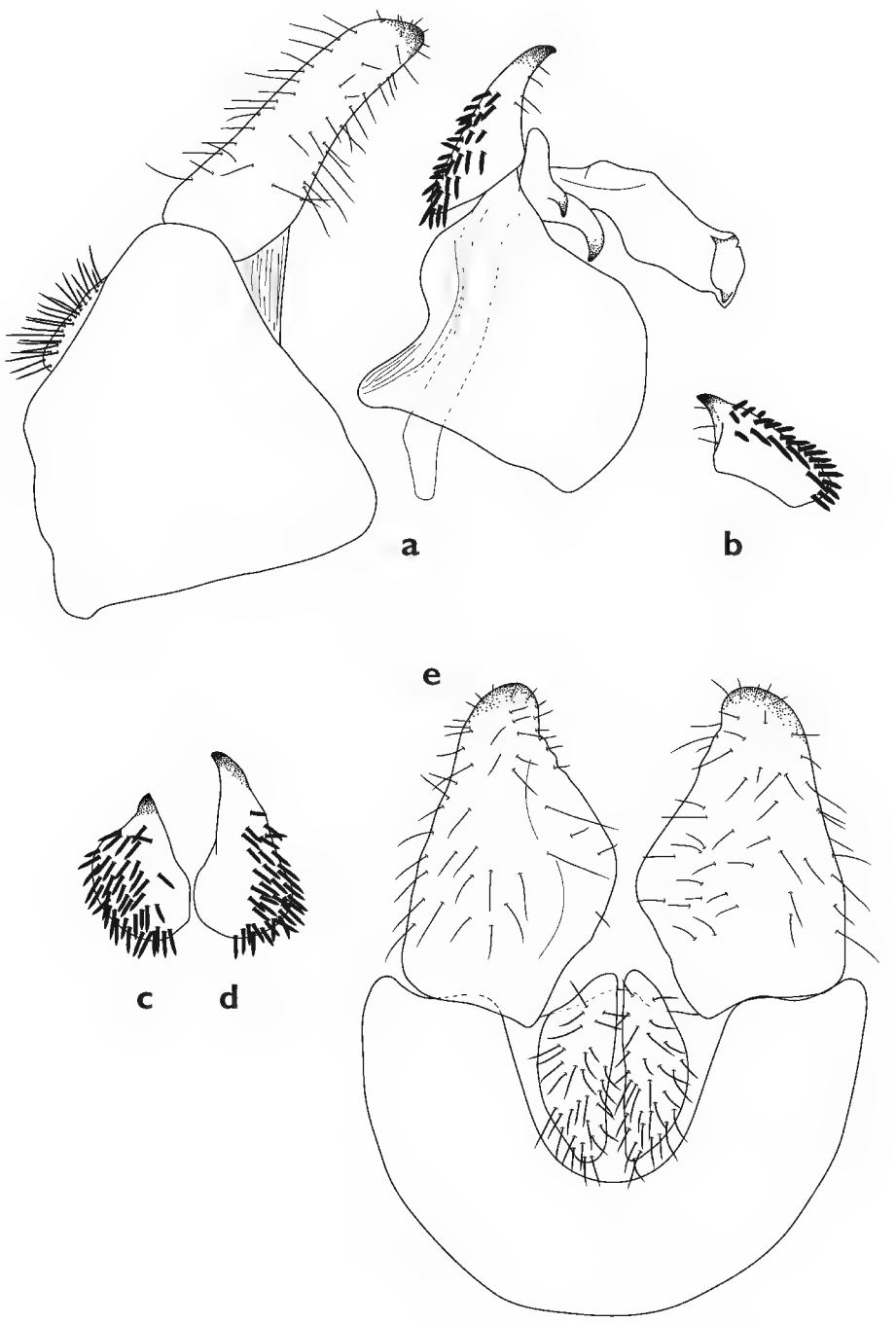


Figure 46. *Eosphaerophoria dentiscutellata*, male genitalia **a** left lateral view **b** right superior lobe, lateral view **c** right superior lobe, dorsal view **d** left superior lobe, dorsal view **e** tergite 9, cerci and surstyli, dorsal view.

ally; metacoxa and trochanter yellow; metafemur yellow on basal 1/2, black on distal 1/2; metatibia black; metatarsus black, golden yellow and black pilose.

Abdomen. Fig. 39. Dorsum mainly black, black pilose except 1st tergum and anteriorly 2nd tergum yellow pilose laterally; 1st tergum black, yellowish on basal and lateral margin; 2nd tergum black dorsally, narrowly yellow laterally on basal 3/4 continuing the yellow margin of 1st tergum; 3rd tergum black with basoanterior very narrow black fascia not reaching margins and with basal narrow yellow fascia (about 1/5 of tergum length) produced posteriorly in a medial small triangular emargination, with lateral margin yellow on anterior 1/2; 4th tergum similar to 3rd, black with basoanterior very narrow black fascia not reaching margins and with basal yellow fascia produced posteriorly in a medial small triangular emargination, broader than yellow fascia of 3rd tergum (about 1/4–1/3 of tergum length), with lateral margin yellow on anterior 1/2; 5th tergum black with 2 lateral triangular yellow maculae on basal 1/3,

leaving median 1/2 or more black; 6th tergum yellowish, black medially; sterna yellowish, yellow pilose except 4th sternum with some long thin black hairs medially on posterior margin; 3rd sternum slightly produced medially into a projection with 2 tips narrowly separated with black setulae close to posterior margin; 4th sternum with posterior margin produced medially into 2 projections with black setulae; male genitalia as figured (Fig. 48).

Female. Paralectotype female lacks the head, but some details are known from original description. Similar to male except for normal sexual dimorphism and face yellow with a medial black vitta. Legs: probasitarsomere dark yellow, darker than other tarsomeres; metafemur slightly more yellow basally, about 3/5, black on apical 2/5. Abdomen: 3rd and 4th terga similar to male but anterior yellow fascia narrower and posterior emargination smaller; 5th tergum with 2 long yellow maculae on anterior 1/2, leaving a narrow black fascia medially on anterior margin; 6th tergum black (Fig. 40). Sterna yellow pilose, with black pile after 5th sternum.

Variation. Examined paralectotype male has the 4th abdominal tergum broken, placed in a microvial with the genitalia and the rest of the terga. The non-examined paralectotype male lacks the head.

The female from Thailand presents some variation compared with the female from the Philippines: face yellow with medial black vitta narrowing down to oral apex; frons completely black on dorsal 1/4 (length between anterior ocellus and lunula), yellow on basolateral 3/4 with a media broad black vitta, about 3/4 of the facial width, without frontal sulcus. Scutellum with few short black pile on posterior margin. Mesotibia with a medial small yellowish macula, not well-defined and could be the result of the use of forceps to arrange the legs. Abdomen similar except 5th tergum with a smaller yellow maculae, leaving median 1/3–1/2 black (Fig. 41).

Type locality. PHILIPPINES: Luzon Island, Calabarzon, Mount Banahaw (alternative spelling: Banáhao). 14°3'54.90"N 121°28'48.24"E.

Types. Frey (1946) based *E. marginata* on a series of 3 male and 1 female specimens from the Philippines collected by G. Boettcher in June and July 1914, which are deposited in the Helsinki collection (ZMUH). From these syntypes, a pinned male labelled "Luzon. // Banahao // VII. 1914" "Paratype" [red label] "Mus. Zool. // Helsinki // N:o *5728*" [number handwritten] "Mus. Zool. Helsinki // Loan No. // D 2009-26" is here designated as the lectotype to fix and ensure the universal and consistent interpretation of the name. The other syntypes have been labelled as paralectotypes.

Lectotype: "Luzon. // Banahao // VII. 1914" "Paratype" [red label] "Mus. Zool. // Helsinki // N:o *5728*" [number handwritten] "Mus. Zool. Helsinki // Loan No. // D 2009-26" "LECTOTYPE // *Eosphaerophoria* // *marginata* // det. X. Mengual 20*09*" [red, second and third lines handwritten] USNM ENT00036545 [1♂, UZMH]. ***Paralectotypes:*** "Luzon. // Banahao // VI. 1914" "Mus. Zool. Helsinki // Loan No. // D*4256*" [number handwritten] "ZMUH" "*Eosphaerophoria marginata R. Frey det.*" "PARALECTOTYPE // *Eosphaerophoria* // *marginata* // det. X. Mengual 20*09*" [yellow, second and third lines handwritten] USNM ENT00036543 [1♂, UZMH]; "Lu-

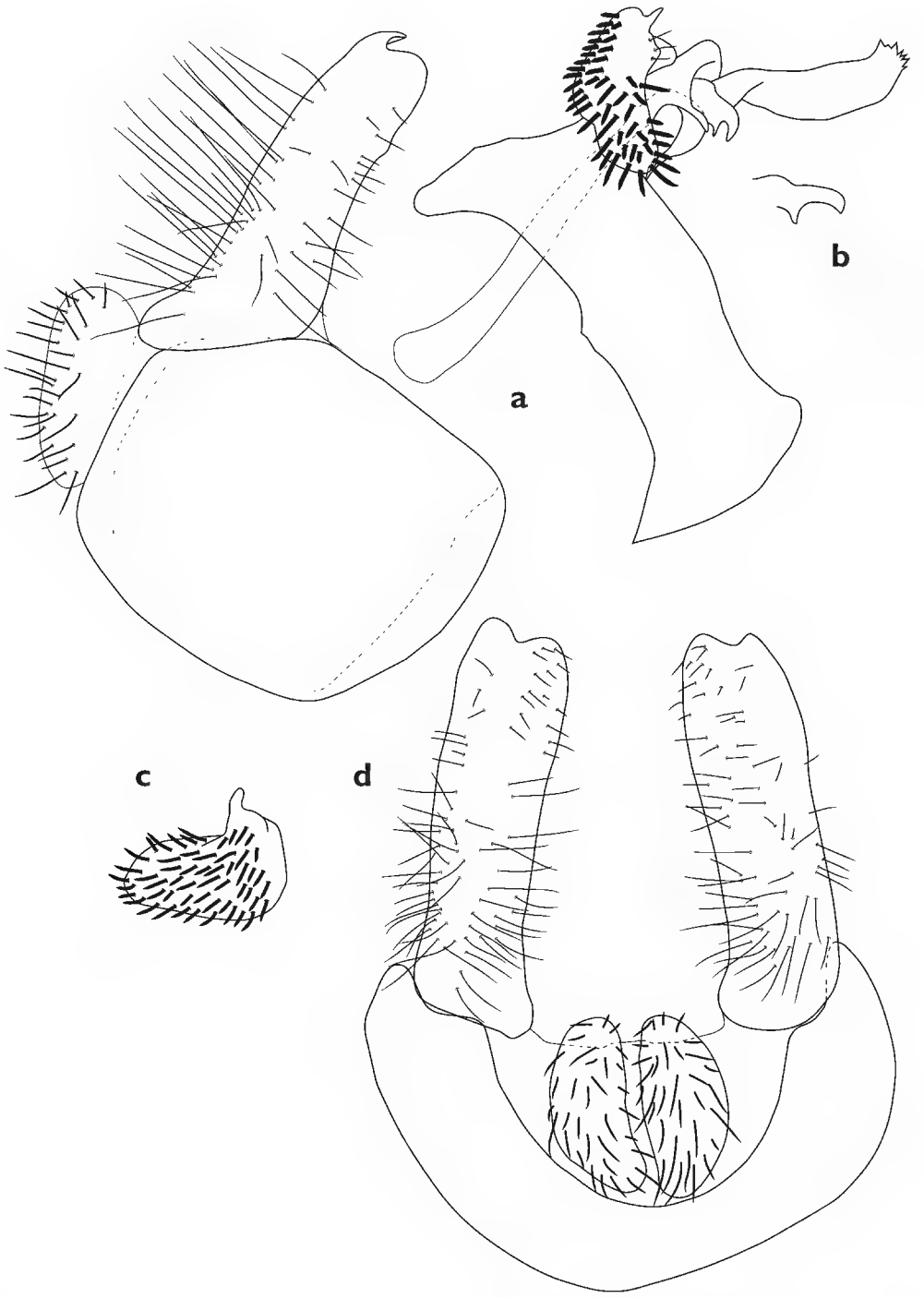


Figure 47. *Eosphaerophoria luteofasciata*, male genitalia **a** left lateral view **b** right basal appendix of aedeagus **c** right superior lobe, dorsal view **d** tergite 9, cerci and surstyli, dorsal view.

zon. // Banahao // VI 1914". "Spec. typ." [pink label] "Mus. Zool. H:fors // Spec. typ. No *14040* // *Eosphaerophoria* // *marginata Frey*" [number, third and fourth lines handwritten] "*Mus. Zool. Hel. // D02-181*" [handwritten] "Zool. Helsinki // Loan No. // D 2009-27" "PARALECTOTYPE // *Eosphaerophoria* // *marginata* // det. X. Mengual 20*09*" [yellow, second and third lines handwritten] USNM ENT00036544, [1♀ without head, UZMH].

Non-examined material. ***Paralectotype:*** "Luzon. // Banahao // VII. 1914" "Mus. Zool. H:fors // Spec. typ. No *14039*" [1♂, UZMH].

Non-type material. "Thailand, Doi Inthanon // natn. Park, road to summit // 800–1800 m // 28.X.1979 // Zool. Mus. Copenhagen Exped." "UZM" "*Eosphaerophoria* // *marginata* // det. X. Mengual '*09*" [first and second lines handwritten] USNM ENT00036556, [1♀, UZMC].

Length (2): body, 5.6–6.2 (5.9) mm; wing, 4.0–4.8 (4.4) mm.

Distribution: Philippines, Thailand.

Differential diagnosis. Species similar to *Eosphaerophoria vietnamensis* with 2nd abdominal tergum black dorsally and 5th tergum with 2 lateral yellow maculae. *Eosphaerophoria marginata* differs from *E. vietnamensis* in having a medial broad black vitta on frons reaching antennal bases. Moreover, *Eosphaerophoria marginata* has bigger yellow maculae on 5th abdominal tergum (see Figs 39 and 42) and narrower yellow fascia on 3rd and 4th terga. Male genitalia is also very similar between these two species, but *E. marginata* has the right superior lobe broader and without a posterior tooth (Fig. 48) being very different from left superior lobe (see comments on *E. vietnamensis*).

Remarks. Although the female from Thailand has a peculiar slightly different abdominal pattern (see variation), we consider it still conspecific with the specimens from the type series from the Philippines. Maybe when more material will be available, the status of this population can be re-evaluated.

***Eosphaerophoria nigrovittata* Mengual, sp. n.**

urn:lsid:zoobank.org:act:7977AD10-D231-40A0-9AB4-53E6952A9C8E

Fig. 36; MorphBank [http://www.morphbank.net/?id=478082]

Vockeroth 1969: 135 as *Eosphaerophoria* sp. (citation).

Male. Unknown.

Female. *Head*. Face straight, broad, with distinct round tubercle, yellow with medial broad black vitta (about 1/2 of face width) narrowing ventrally to oral apex, yellow pilose; gena yellow; oral apex and oral margin brownish; lunula black; frons completely black on dorsal 2/5 (length between anterior ocellus and lunula), yellow on basolateral 3/5 with medial broad black vitta (about 2/3 of frons width) that reaches lunula and continues laterally with black facial vitta, yellow pilose; vertex and vertical triangle black, black pilose; ocelli brownish; antenna yellow, scape brown, basoflagellomere brown dorsally, oval; arista brown; occiput mainly black, yellow ventrally, yellow pilose an silvery pollinose ventrally, black pilose and golden pollinose dorsally.

Thorax. Scutum mainly black, shiny medially, black pollinose laterally, yellow laterally with lateral yellow stripe from postpronotum to scutellum, narrower after transverse suture with ventral black area, golden brown pilose; postpronotum yellow; notopleuron yellow with distinct posterolateral obtuse protuberance, yellow pilose; scutellum triangular, yellow with dorsomedial triangular black area continuing from posterior mesonotum, golden brown pilose. Pleura mainly yellow pilose, with only 2 black pile, one on posterior anepisternum and another on anterior anepimeron; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter yellow. *Wing*. Wing bare basomedially.

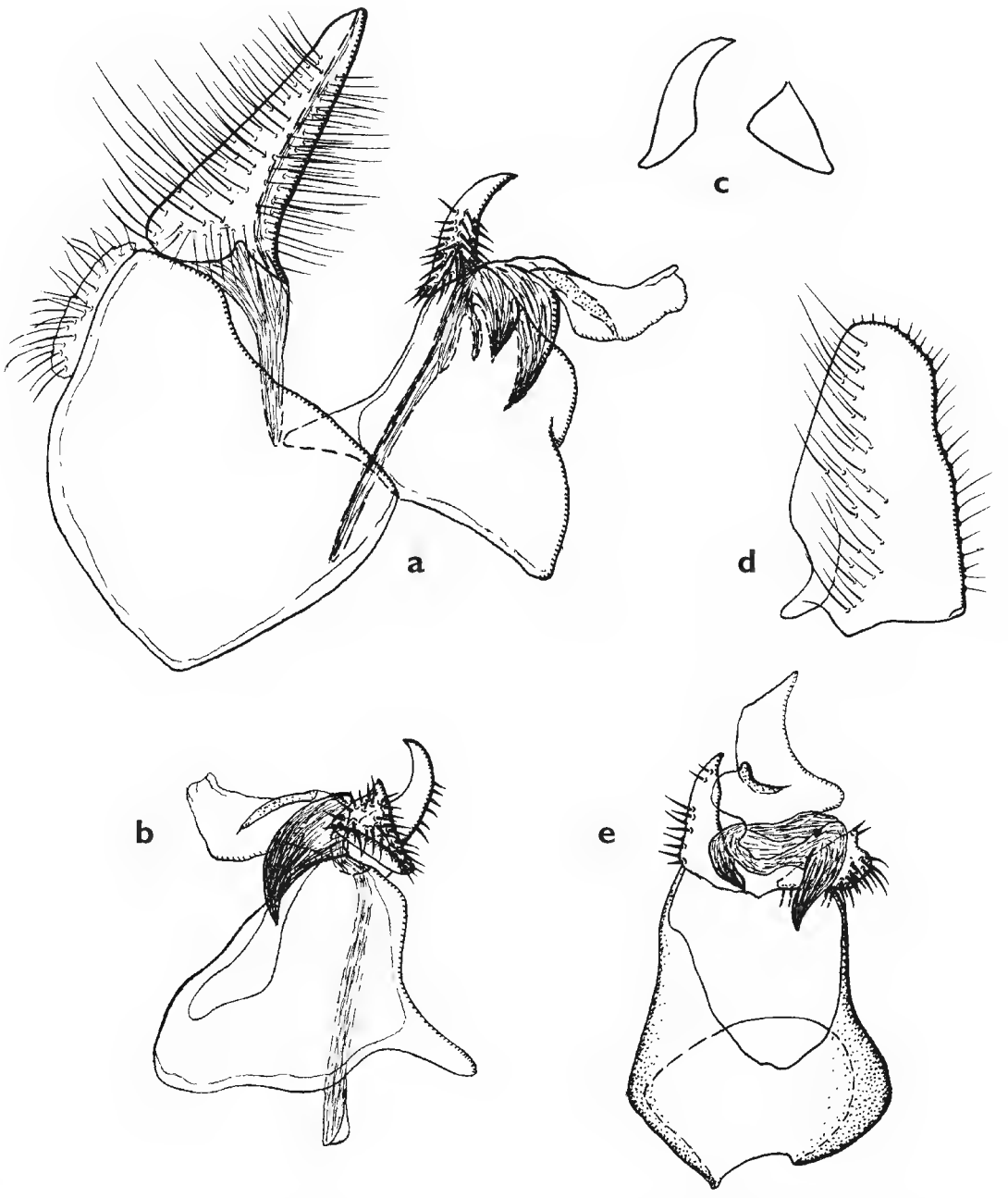


Figure 48. *Eosphaerophoria marginata*, male genitalia **a** left lateral view **b** sternite 9, superior lobes and aedeagus, right lateral view **c** left and right superior lobes, lateral view, outline only **d** left surstylus, dorsal view **e** sternite 9, superior lobes and aedeagus, ventral view (adapted from Vockeroth 1969).

Legs. Pro- and mesoleg entirely yellow, except metacoxa darker, tarsi darker and distal part of mesofemur and basal part of mesotibia slightly darker, yellow pilose except tarsi with short black setulae ventrolaterally; metacoxa and trochanter yellow, yellow pilose; metafemur yellow on less than basal 1/4, black on distal 4/5, brownish pilose; metatibia black, golden brown pilose; metatarsus black, golden yellow and brown pilose.

Abdomen. Fig. 36. Dorsum mainly black, black pilose except 1st tergum yellow pilose laterally; 1st tergum black with anterior and lateral yellow margin, medially reaching anterior margin of 2nd tergum dividing black area in 2 triangular maculae; 2nd tergum black dorsally, narrowly yellow basolaterally; 3rd tergum black with basomedial very narrow black fascia not reaching margins and with basal yellow fascia, about 1/3 of tergum length, produced posteriorly in a medial triangular emargination reaching half length of tergum, yellow on anterior 1/2 of lateral margin; 4th tergum similar to 3rd, basal yellow fascia slightly broader; 5th tergum black with basome-

dial very narrow black fascia not reaching margins and with basal broad yellow fascia (about 1/2 of tergum length) narrowing medially very much; 6th tergum black with 2 basolateral yellow maculae; sterna brownish yellow, yellowish pilose.

Variation. Paratype specimen without black pile on pleura and has the medial black frontal vitta slightly broader, probably due to drying process that darkened the frons. Paratype female has 2nd tergite black medially but with an uncertain lighter point that could be a macula or an artefact resulting from the drying process. Holotype female has a medial small hole in the 2nd abdominal tergite that obscures any existing macula if it was present. Thus, the examined material has no clear evidence to affirm that this species has a medial macula on the 2nd tergite.

Type locality. PAPUA NEW GUINEA: Morobe, Bulolo, NE Wau. 7°20'42.92"S 146°43'5.31"E.

Type. ***Holotype:*** "NEW GUINEA: NE // Wau, 1100–1200 m // VI.1968" "N.L.H. Krauss // Collector // BISHOP MUSEUM" "HOLOTYPE // *Eosphaerophoria* // *nigrovittata* // det. X. Mengual 20*09*" [red, second and third lines handwritten] USNM ENT00036559 [1♀, BPBM]. ***Paratype:*** "Neth. Ind.-American // New Guinea Exped. // Araucaria Camp 800 m // *11*.iii.1939L.J. Toxopeus" "PARATYPE // *Eosphaerophoria* // *nigrovittata* // det. X. Mengual 20*09*" [yellow, second and third lines handwritten] USNM ENT00036563 [1♀, RNH].

Length (1): body, 5.8 mm; wing, 5.1 mm.

Distribution: Papua New Guinea, Indonesia.

Etymology. The specific epithet is derived from the Latin *nigro* meaning black, blackened (Brown 1956: 149), and the Latin *vittata* meaning decorated or bound with a ribbon (Brown 1956: 660), and it refers to the characteristic broad medial black vitta of the face. Species epithet to be treated as adjective.

Differential diagnosis. Female with a medial broad black facial vitta, very distinctive. It has the largest black facial vitta in the genus. *Eosphaerophoria nigrovittata* also has a characteristic broad abdomen (see Fig. 36). Similar to *E. bifida* with 5th tergum with a yellow fascia, but *E. bifida* has yellow face and a central elongated yellow macula on 2nd abdominal tergum.

Eosphaerophoria punctata Claussen & Weipert, 2003

Figs 23, 25, 26, 27, 30.

Eosphaerophoria punctata Claussen & Weipert, 2003: 352. Type locality: Nepal, Annapurna region, Valley of Marsyangdi, 47 km northeast of Pokhara. Holotype 1♀ [Institut für Biologische Studien, J. Weipert Colln., Plaue, Germany]. Claussen & Weipert, 2003: 355, Figs 32, 33, 35, 36, 37 (abdomen, wing, face profile, frontal and dorsal head view).

Type locality. NEPAL: Gandaki, Kaski. Annapurna region, Valley of Marsyangdi, 47 km northeast of Pokhara. 28°17'10.16"N 84°01'21.27"E.

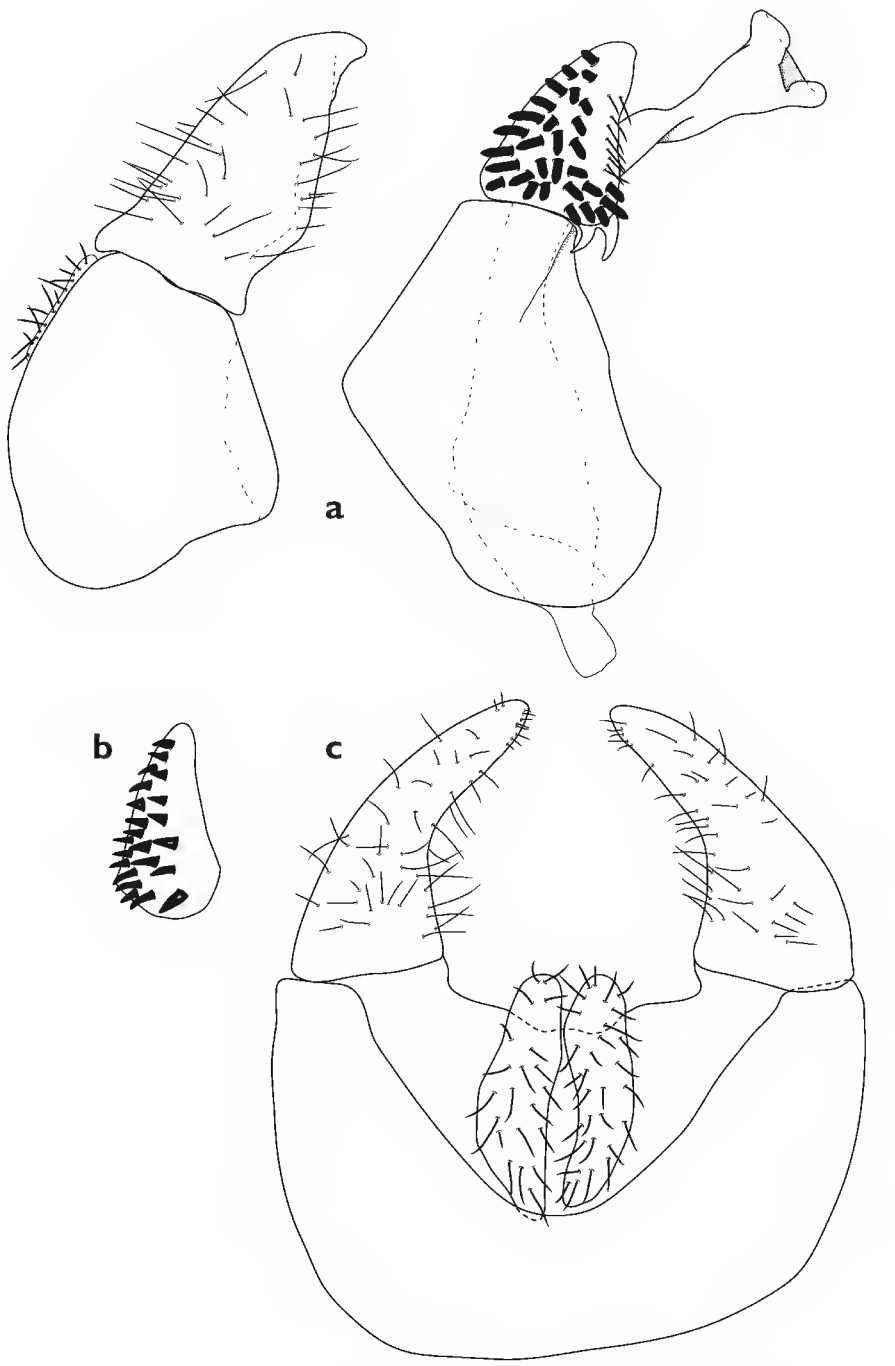


Figure 49. *Eosphaerophoria symmetrica*, male genitalia **a** left lateral view **b** right superior lobe, dorsal view **c** tergite 9, cerci and surstyli, dorsal view.

Non-examined material. ***Holotype:*** Nepal, Annapurna region, Valley of Marsyangdi, 47 km northeast of Pokhara. 1700m., 21.IX.1992, leg. J. Weipert [1♀, Institut für Biologische Studien, J. Weipert Colln., Plaue, Germany].

Distribution: Nepal.

Differential diagnosis. Species with notopleuron not produced posterolaterally, very distinctive with a medial yellow macula on 2nd abdominal tergum. Similar to *E. symmetrica*, but differs from this species by having a medial black vitta on frons (Figs 26, 27), and the 1st abdominal tergum almost entirely yellow (Fig. 30). In the original description, Claussen and Weipert (2003) gave a clear diagnosis to separate *E. punctata* from the then known species as follows: "similar to *E. dentiscutellata* (Keiser, 1958), with the following differences: a) scutellum without tooth on apical margin; b) basitarsus of fore leg pale, not darker than following tarsal segments; c) apex of f2 and base of t2 narrowly black; d) tarsomeres of p2 narrowly black basally; e) tergite 1 pale

yellow, apical margin narrowly black; f) tergite 2 with yellow median macula *(Fig. 30)*; g) tergite 5 with a complete subbasal yellow band; h) notopleuron simple, without lateral protuberance *(similar to Fig. 29)*."

Remarks. Claussen and Weipert (2003) described *E. puncatata* from a unique female collected in Nepal. The holotype is in the personal collection of Jörg Weipert in Plaue, Germany and was unavailable for the present study.

***Eosphaerophoria symmetrica* Mengual, sp. n.**
urn:lsid:zoobank.org:act:62588E50-7113-4DE3-83F9-6BA7827EC755
Figs 31, 49; MorphBank [http://www.morphbank.net/?id=478083]

Vockeroth 1969: 135, in part as *E. dentiscutellata* (citation).

Male. *Head*. Face straight, narrow becoming broader ventrally, with distinct round tubercle, yellow, yellow pilose; gena yellow, yellow pilose; lunula yellow; frons completely black on dorsal 1/3 (length between anterior ocellus and lunula), yellow on ventral 2/3, yellow pilose on yellow areas and dark pilose on black areas; dichoptic; vertex and vertical triangle black, black pilose; ocelli brownish; antenna yellow, basoflagellomere orange, brown dorsally, oval; arista brown; occiput mainly black, yellow ventrally, yellow pilose an silvery pollinose ventrally, black pilose and golden pollinose dorsally.

Thorax. Scutum mainly black, shiny medially, black pollinose anterior and laterally, yellow laterally with lateral broad yellow stripe from postpronotum to scutellum, slightly narrower after transverse suture with ventral black area, golden brown pilose except lateral yellow stripe with yellow hairs; postpronotum yellow; notopleuron yellow without posterolateral protuberance; scutellum subtriangular, more round than in other species, yellow with dorsomedial small subtriangular black area, golden brown pilose; pleura yellow pilose; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter yellow. *Wing*. Wing bare basomedially.

Legs. Pro- and mesoleg entirely yellow, except distal part of mesofemur and basal part of mesotibia slightly darker, yellow pilose except tarsi with short black setulae ventrolaterally; both metalegs are broken on basal part of the femur, but metacoxa, metatrochanter and basal section of metafemur yellow, yellow pilose.

Abdomen. Fig. 31. Dorsum mainly black, black pilose except 1st, 2nd and 3rd terga yellow pilose laterally; 1st tergum black with anterior and lateral yellow margin, medially reaching anterior margin of 2nd tergum dividing black area in 2 triangular maculae; 2nd tergum black dorsally with dorsomedial elongated yellow macula, narrowly yellow laterally on basal 3/4 continuing the yellow margin of 1st tergum; 3rd tergum black with basomedial very narrow black fascia and with basal yellow fascia, about 1/4 of tergum length, becoming broader medially and produced posteriorly in a medial triangular emargination reaching half length of tergum, yellow on anterior 2/3 of lateral margin; 4th tergum black with basomedial narrow black fascia and with basal

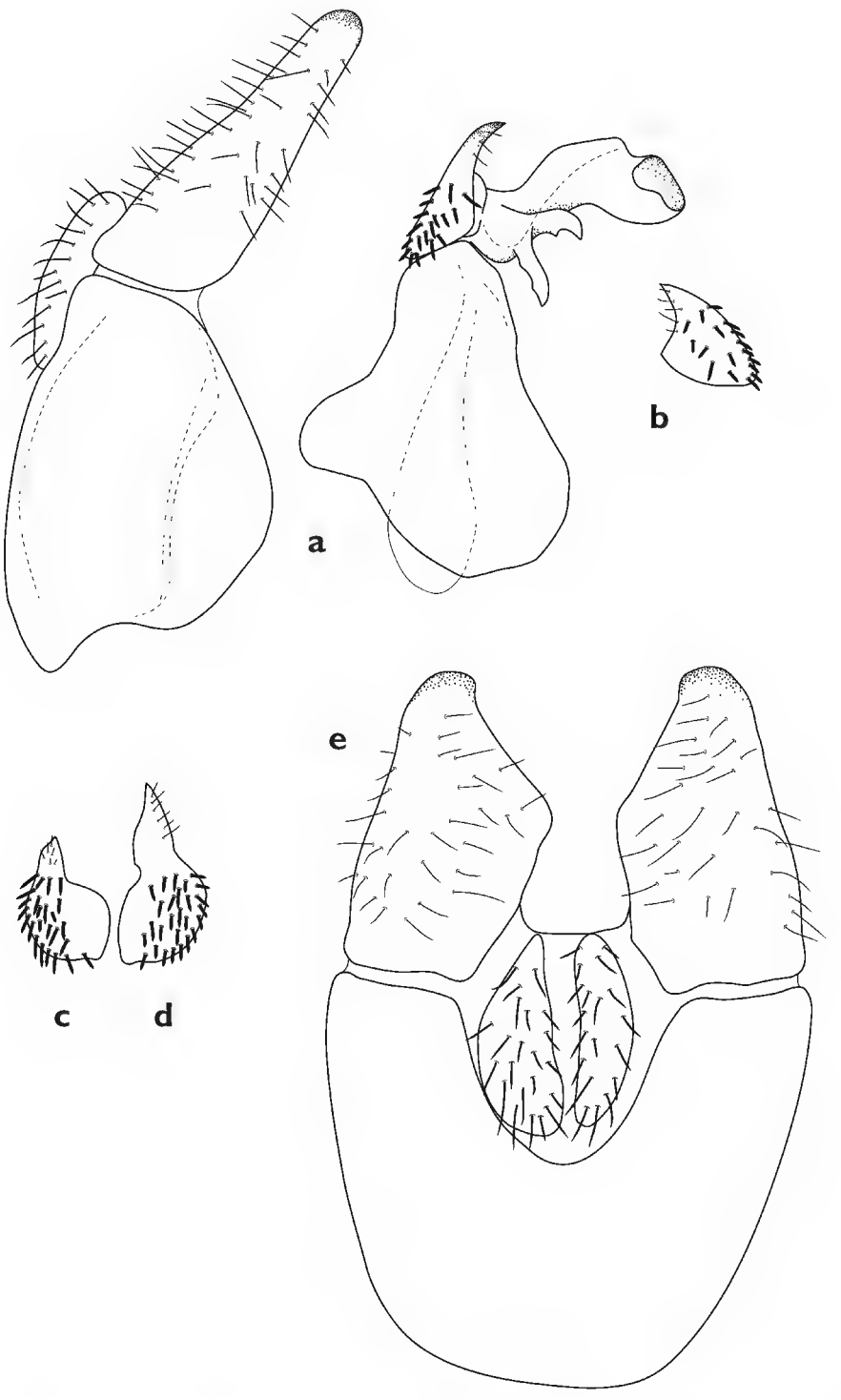


Figure 50. *Eosphaerophoria vietnamensis*, male genitalia **a** left lateral view **b** right superior lobe, lateral view **c** right superior lobe, dorsal view **d** left superior lobe, dorsal view **e** tergite 9, cerci and surstyli, dorsal view.

yellow fascia slightly broader, about 1/3 of tergum length, produced posteriorly in a medial triangular emargination reaching half length of tergum, yellow on anterior 1/2 of lateral margin; 5th tergum black with basal narrow black fascia and with anterobasal yellow fascia narrowing medially, yellow on anterior 1/2 of lateral margin; sterna yellow, yellow pilose; male genitalia as figured (Fig. 49).

Female. Unknown.

Type locality. VIETNAM: Lam Dong, Dà Lat. 11°56'43.51"N 108°26'31.59"E.

Type. ***Holotype:*** "VIET NAM // Dalat, 1500 m // *11.IX.*1960" "J.L. Gressitt // Collector // BISHOP MUSEUM" "HOLOTYPE // *Eosphaerophoria* // *symmetrica* // det. X. Mengual 20*09*" [red, second and third lines handwritten] USNM ENT00036554 [1♂, BPBM].

Length (1): body, 6.3 mm; wing, 4.5 mm.

Distribution: Vietnam.

Etymology. The specific epithet is derived from Greek *symmetros* meaning corresponding part for part, proportional, symmetrical (Brown 1956: 306), and it refers to the symmetrical superior lobes of the male genitalia. Species epithet to be treated as adjective.

Differential diagnosis. Species with notopleuron not produced posteroalterally and a yellow macula on 2nd abdominal tergum. Similar to *E. punctata*, but differs in having the frons yellow on ventral 4/5 and 1st abdominal tergum yellow with 2 posterior subtriangular black maculae.

Remarks. This species is very similar to *E. punctata*. Both species share a unique morphological character with *E. bifida*: a medial yellow macula on 2nd abdominal tergum. *Eosphaerophoria symmetrica* could be the male of *E. punctata* because they also have in common the absence of the posterolateral obtuse protuberance of notopleuron, but they differ in the abdominal pattern of the 1st tergum and the frons. Nonetheless, due to the low number of records/specimens of this genus and the morphological differences, we consider *E. symmetrica* as a species different from *E. punctata*. *Eosphaerophoria symmetrica* and *E. vietnamensis* are described from the same locality, but they present several differences that make them easy to distinguish: *E. symmetrica* has a yellow macula on 1st abdominal tergum, and a yellow fascia on 5th tergum (Fig. 31). *Eosphaerophoria vietnamesis* has 2nd tergum black with yellow lateral margin and two yellow maculae on 5th tergum (Fig. 42). Moreover, the superior lobes of the male genitalia in *E. vietnamensis* are asymmetrical (Fig. 50), unlike *E. symmetrica* which has them symmetrical (Fig. 49).

***Eosphaerophoria vietnamensis* Mengual, sp. n.**

urn:lsid:zoobank.org:act:6BE779D2-C252-4B44-AE9C-162DD0FDEBAF

Figs 42, 43, 50; MorphBank [http://www.morphbank.net/?id=478084]

Vockeroth 1969: 135, in part as *E. dentiscutellata* (citation). Mengual et al. 2009: 8, as *new species* (citation).

Male. *Head*. Face straight, with distinct round tubercle, yellow, yellow pilose; gena yellow, yellow pilose; lunula yellow; frons completely black on dorsal 2/5 (length between anterior ocellus and lunula), yellow on ventral 3/5 with medial black triangular emargination abruptly narrowed reaching the 1/2 of yellow area, not reaching lunula, with small tubercle dorsally to frontal sulcus elevating vertex, yellow pilose in yellow areas and dark pilose in black areas; dichoptic; vertex and vertical triangle black; ocelli brownish; antenna orange, basoflagellomere dark brown on dorsal 1/2, oval; arista brown; occiput mainly black, yellow ventrally, silvery pollinose and yellow pilose ventrally, black pilose and golden pollinose dorsally.

Thorax. Scutum black, shiny medially, black pollinose laterally, golden brown pilose with yellow pile on notopleuron, yellow laterally with lateral yellow stripe

from postpronotum to scutellum, narrower after transverse suture with ventral black area; postpronotum yellow; notopleuron yellow with small posterolateral protuberance, not as evident as in *E. dentiscutellata*; scutellum triangular, pointed posteriorly with small blunt tubercle on medial posterior margin, yellow with dorsomedial triangular black area continuing from posterior mesonotum, brownish pilose; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with a dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter yellowish. *Wing*. Wing bare basomedially.

Legs. Pro- and mesoleg entirely yellow, except distal part of mesofemur and basal part of mesotibia dark, yellow pilose except tarsi with short black setulae ventrolaterally; metacoxa and trochanter yellow; metafemur yellow basally, black distally on less than 1/2, with 2 ventral rows (one posteroventral and another anteroventral, less evident) of short strong black spine-like setulae on the apical 1/2; metatibia black, black pilose; metatarsus black, black pilose dorsolaterally and golden pilose ventrolaterally.

Abdomen. Fig. 42. Dorsum mainly black, dorsally black pilose, 1st tergum and anterior part of 2nd tergum laterally yellow pilose; 1st tergum black with very narrow yellow fascia on anterior margin following sclerite shape, and lateral yellow margin; 2nd tergum black, yellow on anterior 1/3 of lateral margin continuing the yellow lateral margin of 1st tergum; 3rd tergum black with basal narrow yellow fascia, about 1/5 of tergum length, becoming broader medially and ending in a posteriorly pointed emargination at medial point reaching the 1/3 of tergum length, yellow on anterior 1/2 of lateral margin; 4th tergum similar to 3rd, black with basal broader yellow fascia, about 1/3 of tergum length, produced posteriorly in a medial triangular emargination reaching half length of tergum, yellow on anterior 1/2 of lateral margin; 5th tergum black with 2 anterolateral small yellow maculae, difficult to see on dorsal view; sterna brownish yellow, yellow pilose; 4th sternum with posterior margin produced medially into 2 projections with black setulae; male genitalia as figured (Fig. 50).

Female. Similar to male except for normal sexual dimorphism and: face yellow with medial diffuse black vitta narrowing to tubercle tip not reaching oral apex; lunula black; frons completely black on dorsal 1/4 (length between anterior ocellus and lunula), yellow on basolateral 3/4 with medial broad well-defined black vitta slightly narrowing ventrally (about 3/5 of frons width) and reaching lunula; scutellum without blunt knob on posterior margin, with dorsomedial black area smaller. Metafemur apparently without ventral black setulae except one seen on left metaleg. 1st tergum black with anterior and lateral yellow margin, medially reaching the anterior margin of the 2nd tergum dividing black area in 2 triangular maculae; 3rd abdominal tergum black with basomedial very narrow black fascia and with basal yellow fascia, about 1/5 of tergum length, produced posteriorly in a medial triangular emargination reaching half length of tergum, yellow on anterior 1/2 of lateral margin; 4th abdominal tergum black with basomedial very narrow black fascia and with a basal broader yellow fascia, about 1/3 of tergum length, not produced posteriorly, yellow on anterior 1/2 of lateral margin;

5th abdominal tergum black with 2 basolateral yellow maculae, leaving the medial 1/3 black, yellow on lateral 1/2; 6th abdominal tergum black with 2 anterolateral yellow maculae (Fig. 43); 6th, 7th and 8th sterna with long black pile on posterior margin medially.

Variation. A couple of male specimens have the frons with a medial black very narrow vitta continuing from the abruptly narrowed emargination to lunula. In these cases, this thin vitta reaches lunula, and specimens have the lunula a bit darker medially. Another male individual has no posterior small blunt knob on scutellum, and its posterior margin is more rounded. Some specimens present the metafemur with short black setulae on the apical 2/3, but others on less than apical 1/2. We think that these setulae can be lost in part in dried pinned specimens.

Type locality. VIETNAM: Lam Dong, Dà Lat. 11°56'43.51"N 108°26'31.59"E.

Types. ***Holotype*:** "VIET NAM // Dalat, 1500 m // *11.IX.*1960" "J.L. Gressitt // Collector // BISHOP MUSEUM" "HOLOTYPE // *Eosphaerophoria* // *vietnamensis* // det. X. Mengual 20*09*" [red, second and third lines handwritten] USNM ENT00036546 [1♂, BPBM]. ***Paratypes:*** "VIET NAM // Dalat, 1500 m // *11.IX.*1960" "J.L. Gressitt // Collector // BISHOP MUSEUM" "PARATYPE // *Eosphaerophoria* // *vietnamensis* // det. X. Mengual 20*09*" [yellow, second and third lines handwritten] USNM ENT00036031, ...036547, ...036548, ...036549 [2♂, BPBM; 2♂, USNM]; "VIET NAM // 6km SW, Dalat // 1550 m. // 11.ix.1960" "J.L. Gressitt // Collector" "PARATYPE // *Eosphaerophoria* // *vietnamensis* // det. X. Mengual 20*09*" [yellow, second and third lines handwritten] USNM ENT00036550, ...036551 [2♂, USNM]; "VIET NAM // Dalat, 1550 m // 11.IX.1960" "J.L. Gressitt // Collector" "PARATYPE // *Eosphaerophoria* // *vietnamensis* // det. X. Mengual 20*09*" [yellow, second and third lines handwritten] USNM ENT00036552 [1♀, USNM].

Non-type material. "MALAY PENINS: // PAHANG, F.M.S. // Fraser's Hill *4200* ft. // *12.7.*1*936* // H.M. Pendlebury. // F.M.S. Museums." [fifth and sixth lines in the back] "Ex F.M.S. // Museum // B.M. 1955-354", "BMNH", "*Loan # // 11849*" [handwritten] USNM ENT00036553 [1♂, BMNH].

Length (5): body, 4.9–6.1 (5.6) mm; wing, 4.0–4.7 (4.3) mm.

Distribution: Vietnam, Malaysia (?).

Etymology. The specific epithet is derived from the country's name where the species was found abundantly, Vietnam, and the Latin suffix *-ensis* denoting place, locality, country, or belonging to, pertaining to (Brown 1956: 45, 303). Species epithet to be treated as adjective.

Differential diagnosis. Species with 2nd abdominal tergum black dorsally and 2 lateral yellow maculae on 5th tergum, with notopleuron produced posterolaterally. Similar to *E. marginata*, but *Eosphaerophoria marginata* has bigger yellow maculae on the 5th abdominal tergum (see Figs 39 and 42) and narrower yellow fasciae on the 3rd and 4th terga. The male genitalia is very similar in these two species, but *E. marginata* has the right superior lobe broader and without a posterior tooth (Fig. 48) being very different from left superior lobe. *Eosphaerophoria vietnamensis* also has asymmetrical

superior lobes, but the right superior lobe has a posterior tip or tooth and is thinner in the posterior section than that in *E. marginata* (see Fig. 50b).

Remarks. *Eosphaerophoria vietnamensis* and *E. symmetrica* were both collected in Vietnam, but they can be easily differentiated by the abdominal pattern (see Figs 11, 22, 23) and male genitalia (see Figs 49, 50).

The Malaysian specimen, collected in the same area of type locality for *E. brunettii*, is tentatively included in this species based on colour pattern of 1st and 2nd abdominal terga, the lateral yellow stripe of the scutellum and the metaleg. But because the posterior part of abdomen and male genitalia are lost, it can not be identified with certainty.

Conclusions

A total of eight new *Eosphaerophoria* species were described in this study, totalling 11 known species. Previous authors (Vockeroth 1969; Claussen and Weipert 2003) cited most of the studied specimens as undescribed or identified as other species. In this work, we reported three new specimens of *Eosphaerophoria*. Two of them belong to new species described from Indonesia and Malaysia (*Eosphaerophoria hermosa*, *E. brunettii*), constituting the first material examined of this genus from these countries. The third specimen never cited before was identified as *E. vietnamensis*, also from Malaysia. With these three new records, a total of just 25 specimens (16♂ 9♀) of *Eosphaerophoria* are known today.

The other new species were described from material published under different names. Vockeroth (1969) grouped some specimens of the new species described here under a different name. His concept of *E. dentiscutellata* has been shown here to include two new species, *E. vietnamensis* and *E. symmetrica*. Vockeroth (1969) also examined a new species from Papua New Guinea, but he did not describe it. In this revision, four new species were described from Papua New Guinea: *E. adornata*, *E. bifida*, *E. luteofasciata* and *E. nigrovittata*.

Eosphaerophoria is a unique and "aberrant" (*fide* Vockeroth 1969) endemic in the Australasian and Oriental Regions. Specimens of this genus are found in five different Biodiversity hotspots (*sensu* Myers et al. 2000), including Sundaland, Wallacea, Philippines, Indo-Burma and Sri Lanka. However, New Guinea is not included in any hotspot but is the area with the highest number of described species. This presence in very biodiverse regions prompts us to consider that more new species of this genus could be sampled in the future, especially by operating Malaise traps which have taken most of the presently known specimens. More collecting effort in this area, especially New Guinea Island, is needed to understand the diversity of Diptera (including Syrphidae), which probably is underestimated due to the low number of field surveys; most of them carried out in the mid 20th century.

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Appendix A

General information (XLS format) about localities and elinks of *Eosphaerophoria* specimens of the World. File format: Microsoft Excel (1997–2003). doi: 10.3897/zookeys.33.298.app.1.ds.

Note: The spreadsheet contains updated information about the localities of all known specimens of the genus *Eosphaerophoria*. We have not included the coordinates because the exact location is difficult to establish in some cases, but they are provided in the main text using Google Earth. USNM numbers correspond to barcode labels present in all the specimens. The last column provides the MorphBank elinks for the collections of images of each taxon.

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Appendix B

World distribution for *Eosphaerophoria* specimens. File format: Google Earth Placemark. doi: 10.3897/zookeys.33.298.app.2.ds.

Note: The kml file contains all the information about every specimen of *Eosphaerophoria* in the World. For each specimen, data of locality, altitude, collecting date, collector and sex are provided. Additionally, the holding institution, the USNM collection number, the type material and the elink to MorhpBank images are also included for each *Eosphaerophoria* specimen.

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Citations of the datasets:

Dataset published as Appendix A:

Citation: Mengual X, Ghorpadé K (2010) The flower fly genus *Eosphaerophoria* Frey (Diptera, Syrphidae). DATASET. File format: Microsoft Excel (1997–2003). doi: 10.3897/zookeys.33.298.app.1.ds. ZooKeys 33: 39–80. doi: 10.3897/zookeys.33.298

Dataset published as Appendix B:

Citation: Mengual X, Ghorpadé K (2010) The flower fly genus *Eosphaerophoria* Frey (Diptera, Syrphidae). DATASET. File format: Google Earth Placemark. doi: 10.3897/zookeys.33.298.app.2.ds. ZooKeys 33: 39–80. doi: 10.3897/zookeys.33.298